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Excerpts from upcoming book

A Pirate's Guide to Intellectual Property

by

David Douglas Winters
Juris Doctor

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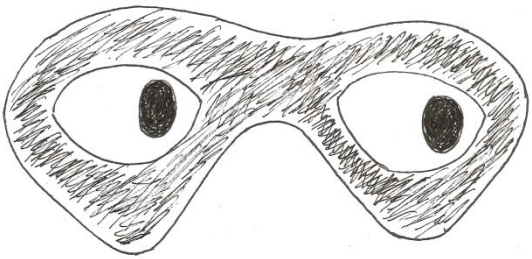
Introduction



Pirate's Rule #1:
It takes a thief to catch a thief.

Pirates be businessmen, me hearties. Profits be their motive. They knows how to weigh risks against benefits. Now, we does not advocate piracy. But, it takes a thief to catch a thief, sez I. So we be not reticent about purloining pages from the roving weasel's rudder-books. Such secrets as is ripped from their logs, to mark rocks, shoals, ambush coves, and sheltered harbor, are what we, here, spreads out on the chart-table.

Pirates know what laws be real laws, and what "laws" be merely politician's fodder. A pirate can gauge just how far the arm of the "law" will reach, where he can thumb is nose at it,* and how to tell if the effort is likely worth the pay-off. The true laws of the sea are inviolate, and care not a barnacle's-slime for the statutory enactments of land-lubber legislators. Learn to discern the difference, like pirates do, or you'll be leavin' that advantage to the roving bandits.

Good seafaring and good business practices hold piracy to a minimum. But, bad practices make piracy practically inevitable. You can

bet'cher flat hat that even a half-drowned bilge-rat will spot a lubberly rigged sail the moment it appears on the horizon. He'll be ready to pounce as soon as you close his range. Just keeping your rigging in order is half the battle. So, you'd best get your own operation ship-shaped and Bristol fashion. The secrets taught here will help you do it.

Learn to think like a pirate. Understand how the enemy thinks, and you'll be much better prepared to fend him off, or avoid him altogether. Further, as a beneficial side-effect, you may find your sailing becomes a fair bit smoother, and the profits on your cargo, more frequent and copious.

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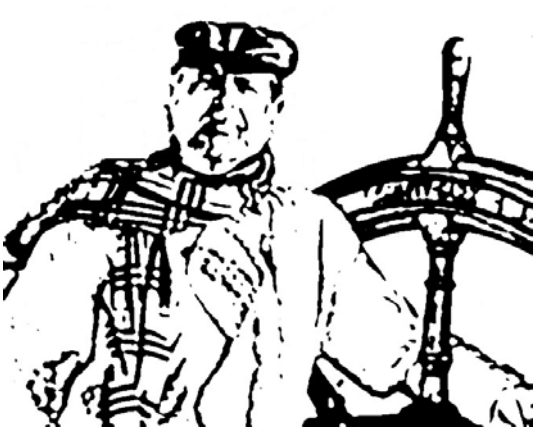
FOOTNOTES

* If he still has a thumb and a nose. (Bonus Pirate's Rule: When you thumb your nose, use the arm *without* the hook.)

2

Confessions of a Techno-Pirate



Pirate's Rule #2: There are only two laws in this world, what a man can do, and what he can't.

I was a techno-pirate. I do confess it. In fact, I state this truth with some pride. Even while actively engaged in my buccaneering, I was always rather boldly up-front about my undertakings. It kept things interesting.

I now relate this history because I found it useful to learn to think like a pirate. There was, and is, much to be learned from pirates. But, like any other conscientious businessmen, pirates tend to be a bit stingy with their proprietary information.

Therefore, when it came to pirating, I had to teach myself the business. I learned by trial and error, on the job, so to speak. However, few people have the necessary time or inclination for such self-education. So, for those more genteel citizens, I offer, here, some of what I learned from buccaneering.

Call it penance.

As I said, while playing the brigand, I was always pretty up-front about my business. I, and my mates, worked on a broad scale. No surreptitious, small time, free-boot downloading, software copying, or cable TV tapping for us. The techno-pirates of my ilk were essentially blockade runners, and as such, we were in the business of supplying goods, not taking them. And supply the goods we did, wholesale, and on a scale that would give Captain Rhett Butler an inferiority complex.

What we smuggled was telecommunications. Similar outlaw bands were spread all over the world and seven seas, privately providing low cost, high quality telecommunications products in what was an otherwise government monopolized, high demand, low supply, poor quality, overpriced market.

This was back in the days when the US had free competition in telecommunications, but nobody else did. All other nations on this planet depended on expensive, inefficient, government-run, bureaucratic behemoths for telephone and telegraph services. The world was poised on the edge of a massive communications revolution. All it needed was a little shove to break loose the monopolies and tumble them over that edge.

We gave the shove.

We started our melee because some of us who possessed a smidgen of law and a touch of technology had stumbled across a loophole between the two. That loophole let us bypass the "official" government monopolies and import our own, free-market, telecommunication services.

The temptation presented by this situation was just too potentially rewarding and too easy to fulfill. We could not resist. And, after all, we were but violating mere arbitrary (and clearly questionable) statutes. A classic case of “malum prohibitum” (“Not evil; merely prohibited.”). As quoted above, from the viewpoint of a pirate, “*There are only two laws in*

this world, what a man can do, and what he can't." [1] The rest are more like guide-lines

We could do it, so, we did it. As I mentioned, our activities were not universally accepted as strictly permissable.[2] But, nobody could stop us.

And our efforts were fabulously successful. As is sure to happen in any free market commerce, our initial economic advantage yielded stupendous profit margins. But, as more and more pirates entered the fray, competition between brigands became increasingly desperate and cut-throat. This drove us to increase quality and decrease costs even more.

The monopolies hated us, and battled to shut us down. But customers loved what we gave them, and they *needed* it. As dictated by the laws of supply and demand, we...and our customers...inevitably won the battles. Granted, this revolution is not yet complete. In some parts of the world it has barely started. But, the outcome is not in question.

Nowadays, I am a counselor-at-law. Some might consider this to be a bit of an incongruous calling for a previously upright and honorable pirate. But, most of our readers have surely had their fill of lawyer jokes, so we shall not further address the matter. Merely note that to whip pirates, you must learn to think like one. So, what I learned as a techno-pirate serves me well as an attorney.

Turning here to matters learned, in this chapter, we address one main lesson, comprising three parts. The lesson addresses how to protect and profit from intellectual property, while avoiding the hazardous rocks-and-shoals of litigation. We teach a tactic that exploits self-regulating qualities of a free market. In our post-industrial society wherein IP production and export are our key sources of revenue, this is a profoundly important subject.

A number of protections are well known and popularly taught, some procedural and some legal. The conventional protections are trade-secrets, copyrights, trademarks, and patents.

Probably the most effective protection is secrecy. Absolute secrecy gives absolute protection against theft of IP. The problem with this method is that in many cases, it is difficult to profit from a product that is totally undisclosed.[3]

Patents and copyrights are probably the best known protections, but, along with trademarks, they share a disadvantage in that they may require expensive legal enforcement action and assistance to exploit, for these protections are based on the power of government coercion, pure and simple. They are effective only where and so far as their supporting legal systems are effective. They depend upon statutes that may prove hard to police. In our world of international commerce, the long arm of the law sometimes seems not particularly lengthy.

In short, these legal protections often prove less than satisfactory. From some perspectives, they seem to be losing ground. Indeed, for many purposes, the present patent and copyright structure, and the means of enforcement, may be approaching obsolescence.

Be this as it may, the situation by no means renders Intellectual Property worthless, for patents, copyrights, and trademarks are not the final word. Other, more effective means of protection exist. In fact, from my own days as a thimble-rigger, operating on the *other* side of the law, I learned that the most effective protection is tactical, not legal.

One preferred tactic, essentially, is to out-compete the pirates. I call it the "Fair Fight" tactic. After all, the last thing any pirate wants is a fair fight. In a "fair" fight, the home team, forewarned and forearmed, and *legal*, accordingly has an advantage. The home team has access to fair profits at little legal risk. But, a pirate is at risk. He takes legal risks with the expectation of stupendous booty gleaned from a poorly served market. Why would he go to all the trouble and risk of cheating, just to obtain mere "fair profit"? Given the choice between a fair fight and a tactical retreat, any sensible pirate will always take the coward's way out and search for easier, more profitable prey.

As mentioned above, the "Fair Fight" tactic has three components. These are:

-Quality

-Price

and

-Supply

At first glance this looks more like the generalities of a business and marketing plan, not a security system. But, if these three requirements

are fulfilled, no maneuvering room is left for the brigands. They are squeezed out and forced to search other waters for their booty.

Let's examine the components in greater detail to see how they work.

By the first element, “Quality,” I mean an honest product. The product is "merchantable." It does what it is purported and reasonably expected to do. The buyer will not be disappointed with his purchase. He will have no cause to seek out a better replacement. If the buyer is happy with his product, one hatch whereby sea-weasels might have otherwise slipped through is firmly battened down.

But if this standard is not met, an invitation to piratical invasion is, by default, extended. An opening is created that the potential smuggler can exploit, legally or otherwise. If your product does not meet the quality standards demanded or expected, somebody else, legally or otherwise, will provide a product that succeeds where yours failed.

"Price" is short for “reasonable price.” The buyers feel they got value for money. If they paid a modest price, they got at least a modest product. But, if they paid a lot, then they got a lot.

If this standard is not met, potential customers will be dissatisfied, and demand for a better deal will emerge. Again, this is the sort of opening a roving bandit welcomes.

“Supply” means that demand is met. Availability of the product is commensurate with the wants and needs of the buyers. If the legitimate purveyors do not meet mass demand for their product, pirates will likely make up for any shortfall, if they can. They will do so because it is profitable.

Using my own bonny crew’s shenanigans in example, we exploited failures of all three elements by a number of national telecommunications services. At that time, the necessary physical infrastructure for cheap telecommunications was already in place. Transoceanic optical cables of high digital capacity were already laid. Excess satellite channels were available at bargain-basement prices.

But, the bloated bureaucracy was not equal to the task of bringing them to fruition. The benefits did not reach the public. Telephone service

was still analog, not digital. It was expensive, of poor quality, and available only in limited quantities.

This left plenty of room for communications corsairs to undercut the abusive, but, "legitimate" telecom companies in all three areas, and we did so with a vengeance. And when we made our product available, fast, cheap, and of high quality, the public seized upon it with true passion.

It is worth noting, here, that no such piracy flourished in the USA. This was not because of stricter enforcement or government coercion. The US had no telecom pirates because free market competition left no weaknesses for pirates to exploit. The industry was already relatively fit and slim. It had trimmed most excess fat long before our “pirate” technology became available. So, the techno-pirates went elsewhere. Like Robin Hood, they choose to plunder the rich, not steal from the poor. This was not from altruism; the rich simply promised better profit margin.

Another case in point was evident when the iPhone® first came out. As the more technically aware readers (we of the “techno-nerds” crowd) will recall, the iPhone® introduced as an expensive gadget of limited availability, was inconveniently restricted to use on only one cell phone network.

This was less than what cell phone users had already learned to expect. It created instant demand for an equivalent system having multi-net capability. Accordingly, only a few days after the I-PHONE release, pirate hackers began to convert iPhones for use on multiple networks. Within only a few weeks, Asian techno-pirates were producing inexpensive, multi-net capable, knock-offs that also overcame a number of publicly perceived technical shortfalls of the original product.

In short, the I-phone, introduced with much fanfare, did not meet customer expectations. It was expensive, but its performance was popularly not judged to justify its cost. Relative to demand, it was in limited supply, but quickly lost benefit of the artificial excess demand resulting from this short supply. Pirates quickly picked up the slack in many markets. Very shortly, thereafter, the Apple updated the original model and rushed the next version to market, apparently to recover that slack. And, eventually, Apple found it necessary to make the phone compatible with multiple carriers.

Somebody should'a told'em earlier. The enemy offers no quarter, and can be compelled to give none.[6] As counselors, our duty is to advise our clients as to viable means by which they may prevent such piracy. Again I pragmatically point out that the best prevention is a good tactical defense-in-depth consisting of three layers:

-Offer an Honest Product (Quality)

-Charge a Reasonable fee (Price)

and,

-Meet demand (Supply)[5]

Now, such standards mean one sort of challenge to major industry, but present a completely different obstacle to the independent entrepreneur. For the small operator, these standards present stiff challenges. The independent entrepreneur, alone in his skiff and facing a vast ocean populated by cruising corsairs, is poorly armed and engined for battle on the high seas.

Intimidating.

But, he needs not face these challenges alone. He may join an armed convoy, so to speak, and sail with more powerful entities.

That is why, for those independent inventors who come to me for counsel, I always include instruction on, and recommend favorite books about, product licensing. The independent operator needs to understand both the advantages and the potential pitfalls of licensing. Small or independent entrepreneurs need to understand how to use licensing and how to choose a licensing partner to strengthen their positions. A good licensing partner can provide bulwark against bigger competitors and can also help the entrepreneur fulfill the three standards of quality, price and supply.

The benefits are easily understood. Complex math is not, for example, required to convey the advantages of fractional royalties over undivided profits. 10% of a million doubloons trumps 100% of ten doubloons without much explanation. And, of course, the cost reduction resulting from mass production further magnifies the potential benefits of having a big partner.

But, then, as any pirate can tell you, everything depends on finding a *trustworthy* cohort. Experience has shown that a number of fields of commerce may prove hazardous to a licensor's navigation.[6]

In any case, having a patent or copyright in place or applied for before opening negotiation with a potential licensee is a good business practice.[7] Your patent or copyright is the stone that tips the scales in your favor. Given that you meet the three "fair fight" tactical components, above, your patent or copyright gives you the advantage you need to decisively prevail.

This is because the potential licensee knows that, although he may be bigger than you, he may not be bigger than the other potential licensees whom you will approach with your patent or copyright documents. So, although your little skiff, alone, may not present much of a threat, the rest of the fleet that you eventually join may be formidable. Thus, the possible payback for any traitorous buccaneer who maneuvers to take your weather-gauge could, indeed, be "Hell".

That, in a nutshell, is our first lesson in how to think like a pirate…and a bit of how to talk like one. To this, I offer only one more mandatory comment.

"Arrrrrgh!" (You may quote me.)

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FOOT NOTES

1. Movie Pirate Jack Sparrow in Pirates of the Caribbean.

2. Some local authorities considered our activity unlawful. But, at that time, *international treaty and convention* came down squarely on our side. So, knowing their claims were on legally shaky ground, the national authorities sought to stop us by *technological* means, only. They threw up technological armor. We figured out how to penetrate it. Demonstrating a basic law of combat, they lost the war, for, "In the race of bullets against armor, bullets ultimately always win." Code breakers always eventually defeat code makers.

3. In the case of our own telecom products, we could not avoid disclosing, or in fact, extolling, what we did. In fact, our marketing benefited from revealing some of our clever methods. So, only the most proprietary details of our operation remained hidden. To anyone with a head for technology, the general workings of our system were immediately obvious, anyway.

4. Referring again to the fictional Captain Jack Sparrow, "Take all you can. Give nothing back!"

5. Note that in using this approach, profits tend to be maximized by fully meeting demand, resulting in an increased sales volume, each sale generating a commensurately more modest profit margin. This is in contrast to depending on much fewer sales for the same quality goods, each sale demanding a much higher profit margin.

6. I have found that, as a rule of thumb, the more any business is based on hype over quality, the greater the risk getting involved with it. It is "available where ever dreams are sold."

7. Analogous to a rule taken from riverboat gamblers rather than upright, hard-working pirates, but, for prudent seamen, valid, just the same, "Always trust the other players at your Poker table, but always cut the cards."

Adapted with permission from an article by the same author, appearing in the Nashville Bar Journal. Their kind authorization is gratefully acknowledged.

3

What's This "IP Stuff" All About?

Pirate's Rule#3: I aint personal.

Intellectual Property (IP) rights are tools. US patents, and copyrights are "tools" created by arbitrary statute. Commerce is their purpose. This is just business; Nothing personal.

Learn your tools. This is an essential part of your shipboard apprenticeship. A seaman, who knows not the difference between a fid and a marlinespike, is unlikely to make effective use of either.

This part about being, "nothing personal" is important. Understand that intellectual properties such as patents or copyrights, are derived from basic" or "inherent" rights. They are merely artificial constructs in the game we call "commerce."* As would be true with any other game rules, we'd be silly to take them personally. Such rules may read pretty strictly, but they are arbitrary and imperfect. In their application, there is generally plenty of latitude. As in any imperfect system, while we may often quibble over details, the sensible philosophy is, "No harm; No foul."** Get your head around it, now, and you may avoid some otherwise costly, non-productive, and flatly wasteful legal quarrels, later.

On the other hand, beware that the same sorts of weasels who blatantly break these rules also apoplectically enforce them in their own

favor. T'aint personal. They treat everybody with the same arrogant attitudes; Equal opportunity abusers, methinks.

The Philosophy of Intellectual Property

Patents and copyrights provide what amounts to contracts between their owners and the public. If you create something original and useful, you can, through these contracts, acquire exclusive rights to commercialize it, for a limited time. In exchange for those rights, you must disclose all the details of your creation. That way we all can make and use it, once your monopoly is expired. Everybody wins.***

Well, at least, everybody wins so long as we stick to these basic principles. Do not assume, however, that statutes and regulations faithfully adhere to them. Legislative divergence from "the true course" can be frequent and frustrating, as is noted on occasion throughout this volume. If we forget these guiding principles, everybody loses in short order.

Also be aware that many, many lubbers, banging about without direction, have not acquired this simple piece of seaman's wisdom. Many legislators may be members of this large, but, unfortunately uninformed, group. Do not take *their* ignorance personally, either. It is merely one of those facts with which you, now a member of the enlightened few, must struggle, forever, hereafter. Do try to teach them, though, if the opportunity should present itself.

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FOOTNOTES

*Trademarks, though, are a whole 'nother kettle of fish, as addressed elsewhere in this tome.

**A similar rule of Law, more formally ensconced is "De minimis non curat lex." (Latin, of course. Are you impressed?) Loosely translated, it means, "The law don't sweat no small stuff."

*** “Everybody wins.” This is the heart and soul of the entire proposition. The artificial and temporary rights in patents and copyrights were created to encourage folks to create useful stuff from which everybody could benefit. Intellectual property is ***not*** a zero sum proposition. In a zero sum game, somebody wins and somebody loses. This is incompatible with the basic principle for which we create intellectual property.

In a zero-sum game, winners, gain only at the expense of somebody else. **The defining quality of zero-sum games is that they generate profit for some without creating anything new for anybody.** Zero-sum undertakings do not create wealth, they only transfer it. Examples of zero-sum games are gambling, day-trading, money-lending, taxation, “wealth-redistribution,” and various other sorts of theft and fraud. Some zero sum games begin corrupt. Some create corruption. All of them ultimately become corrupt****

Unfortunately, much of our original functional copyright structure has been bent to fit the “zero-sum” mentality. Copyrights should be temporary. They are merely business guidelines. But, so far as we can predict, copyrights now endure forever, enforced by criminal penalties. By ignoring the necessity of discernible and dependable limitations on the artificial rights they create, our legislators have created a self-destructive and unsustainable system that serves only the greedy, and even those, only temporarily. The addition of criminal penalties to the mix merely serves to further corrupt the entire system.

We need, in this sailor's jaded opinion, to get our eyes back on the lubbers-line, and correct our course. We need to get this copyright distraction off the bridge and back in the hold where it belongs. It matters not what the rest of the world thinks. Nobody ever won a regatta by *following* the fleet.

****In example, we offer that “33 ½ mph on alternate Friday afternoons only,” speed trap that caught your cousin Vinny in Crook County, Arkansas.

7

Patent Attorneys, Patent Agents, and "Intellectual Property Attorneys"

Pirate's rule #7:

Patent Attorneys don't need no dingy (though some may be a bit dingy, sez I).*

Patent Attorneys

Patent attorneys are hot property. No brag; Just fact.

Understand, US patent attorneys are full-fledged attorneys in every sense.** Every US patent attorney has, effectively, at least TWO law licenses. Each must have licensure from at least one state, and each must also pass a federal examination for admission before the US Patent Bar. The standard that must be met, just to sit for this exam, is rather daunting. The end result is that patent attorneys are essentially both lawyers and engineers. Only about 3 percent of US attorneys are so qualified.

Every patent attorney is fully licensed to practice any sort of law he/she cares to pursue. He can, in addition to practicing patent law, handle tax matters, write license agreements, prepare corporate papers, and, if so moved, handle the occasional speeding ticket or divorce. (This is hypothetical, of course. In reality, you will seldom find one actually wandering outside his/her own lucrative area of specialized patent law.) This is in contrast to attorneys who are NOT patent attorneys, and are,

therefore, permitted to practice any law EXCEPT patent law, and only in the particular states where licensed. **Patent law is solely the domain of the specialist patent attorney, cream of the intellectual crop.**

The patent attorney is privileged to practice before the US Patent Office from within any or all fifty states no matter what state in which he/she resides. In recognition of this privileged status, Patent Attorneys may carry the "Patent Attorney" title on their business cards and stationery, independently of any state levied qualifications.

The process of drafting a patent application is widely recognized as the most complex legal writing task known.*** And even more elite than the patent attorney who writes your patent applications (technically termed a "patent prosecutor") is the litigating patent attorney. A regular patent writing attorney may occasionally stroll across your pond, just to keep in practice, but patent litigators are generally rumored to maintain an altitude of at least eighteen inches above sea-level at all times.

Then, to top it all off, patent attorneys, in general, tend to be really nice folks; Unassuming, but clever, well read, excellent dinner conversationalists, courteous, kind to dogs, and rumored to be great lovers. I would also assert that they are also invariably good-looking, but, the author's photograph may appear elsewhere in this book, and good pirate knows where to stop before he is caught out. So, we respectfully forgoes that, there, assertion, shipmate.

Yet, in view of all this, you will undoubtedly not be surprised that patent attorneys ain't cheap. In fact, the last time we checked, the highest paid lawyer in the United States was a patent attorney. If they were not such admirable company, we'd just term them a necessary evil. But, that would be an unjust disparagement. Patent attorneys really do tend to be worth every doubloon you dole out to them.

That said, price shopping for your patent attorney might prove worth the effort. Patent attorney fee structures vary widely, with attorneys in the major cities and on the coasts commanding the highest prices. But, no matter where they are located, you will find that patent attorneys tend to be of uniformly high quality, all being subject to the same rigorous standards. Price shop among the firms in the Middle-West, or the South, and you may turn up a real find. Look for a small practitioner, or perhaps a semi-retired one. These often provide the best value for the entrepreneur's budget.

Patent Agents

So (ye might ask) what's the tale on them "Patent Agent" characters? What is the difference between a "patent attorney" and a "patent agent"? Seeking an answer, perhaps we can look to good Mr.

Webster. Les'see….He sez an "agent" is defined as an "attorney." Arrrrg. Not particularly illuminaticle. So, let's look up "attorney." Well bash me binnacle; It says an "attorney" is an "agent." It do appear that there be no difference between a "patent attorney" and a "patent agent."

This conclusion is absolutely <u>incorrect</u>.****

We've just run up against one o' them patent law code words, over which the dictionary has no authority. The truth is this. A "patent agent" is a person who is licensed to practice before the US Patent Bar, but essentially nowhere else. He probably has never attended law school. He has no state-issued license to practice law. He cannot write your contracts. He cannot draft your licensing agreements. He cannot file trademarks or copyrights for you.

But, he can draft, file, and process ("prosecute") patent applications. <u>Patent agents are usually much less expensive than patent attorneys.</u> If a simple, naked, patent is all you need, a good patent agent may be just the ticket. However, you will need some luck to find one close by. They are rare, more rare, even, than patent attorneys.

This rarity is unintentional. Patent agents are, like patent law, a creation of statutory social engineering. Patent agents were created to deal with the fact that "real lawyer" patent attorneys are unavoidably few and expensive. It was supposed that many more patent agents would emerge to fill the void, resulting from a shortage of patent attorneys, because the road to becoming a patent agent is so much shorter and less strenuous than that traversed by full-fledged patent attorneys. This plan did not pan out as expected.

The reality is that very few patent agents are, or ever were, available for private hire. Most appear to be employed in-house by large corporations, or as assistants to attorneys in law firms. Patent attorney numbers far surpass those of patent agents. You might ask, "Why is this?" And I will answer.

"I don't know."

Haven't a bloomin' clue.

If you figure it out, do write and enlighten me on the issue.

But, by all means, if a patent agent can do the job you need done, search one out. However, understand that a patent agent cannot offer services in the full range of Intellectual Property matters in the manner that a patent attorney can. A patent agent may not be well prepared to help you construct a master Intellectual Property business strategy. This business strategy is important.

Outing Their Little Secret

You should know of an innocent little secret shared by patent attorneys and patent agents. The secret is that they are invariably closet inventors. They do not merely describe inventions in patent applications. They contribute to them. This is good. Any patent attorney worth his hard-tack helps his client define additional ways of practicing his invention. This is an important function. But, shipmate, it is also inventing, pure and simple. This presents a problem, technically speaking.

The problem is that this creates a legal conflict. Understand, me hearties, that patent law is arbitrary stuff. It is based on mere statutes dreamed up by legislators, regulators, and other clueless land-lubbers. Legislators often miss important navigational details while engaged in their compulsive assertion of fleet command.

As a matter of practical seamanship, conscientious observance of TRUE law requires some discernment. But, because patent law comprises mere arbitrary statutes and regulations, as opposed to "real" law, such as the Common Law, there is little room for such discernment, or distinction, nor for interpretation according to "the spirit of the law."*****

This is where we get our cables fouled. Patent statutes say that every inventor who contributes to an invention must be listed on any the patent application for that invention. Rules of ethics, however, distinctly frown upon patent attorneys who routinely include their own names on their client's patent applications. All the same, to provide proper titivation, a patent attorney must, necessarily, contribute to the inventions appearing on his client's applications.

So, the situation is that:

1. Statutes require all contributing inventors to be listed on any given patent application.
2. Patents attorneys generally contribute to their client's inventions, so they must, theoretically, be listed.
3. As a matter of ethics, but contrary to the regulations, patent attorneys should NOT be routinely listed as inventors on their client's applications. Such self-serving conduct is frowned upon.

How do we deal with this conflict? We just follow time-honored tradition and ignore it. We do not talk about it. We pretend it does not exist. We look upon it with Admiral Nelson's blind eye. We do *not* list patent attorneys as inventors on the patents they prepare, just by virtue their contribution.

So, when you find your patent attorney suggesting new, or clever, or innovative ways to accomplish your invention, just smile gratefully, accept his brilliant contribution, and feign that, all along, it was exactly what you intended to include. In fact, if your attorney suggests new ways that are

NOT particularly clever or innovative, accept those, too. He is probably just re-enforcing the stem, keel, and bulwarks of your patent protection, using complex below-deck structures not apparent to you, nor to others not cognizant of the practitioner's art. That is all part of his job, confidentially speaking.

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FOOTNOTES
*US Patent attorneys reputedly walk on water.

** This is in contrast to "patent attorneys" of, for instance, the United Kingdom, who are essentially the equivalent of US Patent Agents, and, also, in contrast to US "Intellectual Property Attorneys" who usually are *not* licensed as patent attorneys. Because the "Patent Attorney" title is rather prestigious, the term "Intellectual Property Attorney" is usually assumed only by US lawyers who do not possess the qualifications required to practice full-fledged patent law, but still specialize in non-patent fields of intellectual property law, such as trademark, or copyright, or perhaps intellectual property litigation.

***Well, it's the most complex *legitimate* task, anyway. We decline to include for consideration those disastrous Wall Street generated monstrosities termed "mortgage backed securities."

****Take this, however, as a profoundly important lesson. In the world of patent documents, innocuous, unassuming, apparently harmless, words become sneaking and deceitful carriers of special meanings and nuances known only to those initiated into their mysteries. So, beware the words of a patent document. They may not mean what they seem to mean. In the patent world, we begin by interpreting patent terms in accordance with the dictates of old Samuel Johnson's dictionary, that preceded Webster by a good cable length. Additionally, many terms have, in the ensuring centuries, further evolved at a rate that that would amaze even the most rabid Darwinian. These days, much patent generated terminology can be found in *no* dictionary. Compounding this progression, patent attorneys are the only attorneys permitted to be their own lexicographers. What does any particular term mean in a patent? Only your patent attorney knows for sure.

*****To gain a greater understanding of this, allow me to recommend a book, *The Common Law*, a work scribbled out by my infinitely more illustrious, rabble rousing little brother, Brent A. Winters, Esq.

UN NOU ATAC LA INVENTICA ROMANEASCĂ

Ion SANDU

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Acum la început de mileniu trei, pe fondul fenomenului geopolitic de globalizare, traversăm cea mai profundă criză, care lezează toate apectele vieţii omului şi nu numai. Este o criză de sistem, ce afectează atât sfera intelectuală, morală şi spirituală, dar şi mediul, perturbând încadrarea sau reintegrarea ambientală şi pe cea culturală (incluzând reintegrarea ştiinţfică şi tehnologică). Se resimt deja profunde transformări socio-culturale, tranziţie care nu poate fi prevenită, dar poate fi întâmpinată printr-o profundă reexaminare a principalelor premise şi a valorilor spirituale a fiecărei naţiuni în parte.

Pentru România este o perioadă vitregă, de tranziţie profundă, care pare că nu se mai termină, realizată printr-o democraţie „originală", atipică, în care un management intenţionat haotic distruge subliminal şi structural profund societatea românească. O coaliţie din umbră, vehiculată mai ales prin e-mail-uri, în care „codex alimentarius" se intersectează cu Proiectul Roşia Montana sau Roşia Poieni şi cu reîmpărţirea României pe regiuni, acestea şi multe altele fac să alunece societatea în dezechilibru, pe o pantă mereu descendentă. Au fost 22 de ani grei pentru cei multi, ani dificili pentru cei care „toată viaţa au strâns cureaua" pentru a realiza lucruri „măreţe", distruse dintr-o pană de condei. La început, am fost judecaţi de proprii lideri „ca o ţară de vechituri, de ruginături" şi de ce nu, unii chiar au crezut şi au luat-o în serios şi aşa încetul cu încetul au dispărut marile combinate, marile industrii, odinioară mândria ţării. Mai mult, s-au redus o serie de instituţii absolut necesare unui stat modern: centrele de cercetare, clinicile şi spitalele, dar s-au înmulţit multe altele, este delicat să fie enumerate!!!

Cu toate că viaţa de multe ori îţi demonstrează că eşti relativ, vulnerabil şi îţi arată limitele, obligându-te să fii modest, totuşi sunt indivizi pentru care scopurile personale sunt mai presus de orice şi prin mijloace „ne-ortodoxe" s-au strecurat la „conducere". Să nu se uite nicicând că suntem o ţară mare în Europa, un popor vrednic de o istorie milenară, cu

certe valori, dar timorat timp de mulţi ani de dictatura proletară înverşunată, care a permis să iasă la suprafaţă „pleava”. Sunt mulţi oameni cu performanţe profesionale aparte, chiar de invidiat peste graniţe, dar care parcă au fost puşi la zid, aduşi la tăcere. Pentru mulţi tineri de valoare, România a ajuns o ţară fără viitor, în care au rămas puţini dintre cei care scriu cu adevărat istorie, în timp ce mulţi o mimează şi foarte mulţi o distrug.

Guvernele de după ‘90 au stimulat „de faţadă” doar anumite „creaţii”. Nu poţi vorbi de valoare într-un sistem fără principii unanim acceptate, fără grile de evaluare, în care forţa şi banul dictează în detrimentul bunului simţ.

Marile valori ar trebui preţuite şi venerate, acordându-le respectul cuvenit în ierarhia lor. Un exemplu îmi vine acum în minte, cel al eruditului Erasmus, care a demonstrat rolul omului ingenios, al creatorului de nou, pentru care a fost curtat la vremea sa de toate capetele încoronate ale Europei. Erasmus a înţeles destinul şi a ştiut că viaţa şi mai ales istoria va plăti riguros toate „demisiile morale”, falsurile, dar şi „răutatea disimulată” şi mai ales „vocaţia de a dispreţui”.

Se ştie că uneori vremurile devin „prea largi”şi „valorile n-au avengură”, când non-valorile se autoetalează în „sfinţi”, cu toate că ştiu că niciodată nu vor fi profeţi. Reflectând la realitatea operei lui Erasmus, „Elogiul nebuniei”, un adevărat rechizitoriu adus dogmatismului şi sistemelor dictatoriale, în faţa cărora izbândesc doar adevăraţii creatori, prin operele lor, am în minte „Judecata de Apoi”. Nimeni nu poate să rămână nerăsplătit, după cum nimeni nu va rămâne nejudecat. Cel mai dur ne va judeca Istoria.

Deseori, îmi încălzesc sufletul cu gândul la spusele marelui sculptor francez Rodin, care considera că nici o viaţă nu este mai frumoasă decât cea a creatorului, întrucât acesta simte rodul muncii sale şi trăieşte alături de ea apărat spiritual de vicisitudinile vremii. Ştiinţa şi arta trebuie să fie slijite cu credinţă şi pasiune, printr-o muncă asiduă, prin care poţi să uiţi sau să treci mai uşor de asprimile vieţii.

Dintre creatori, după cum susţine şi Erasmus în „Elogiul nebuniei”, „mai nebuni decât toţi nebunii la un loc sunt inventatorii, cărora nimeni şi nimic nu le poate răsplăti efortul şi lipsa de somn”. Este adevărat că în ştiinţă şi în inventică, pe lângă lupta cu greutăţile vieţii, este una mai dură, cea pentru „faima priorităţii”. Creatorii sunt mereu în competiţie cu timpul,

dar nu timpul „zboară neobservat", ei sunt cei care urcă treptele adevărului spre viaţa academică, întru atingerea performanţei preţuite de eternitate.

De ce nu?, lucrurile şi faptele pot rămâne latente sau aşa cum au fost, dacă eşti resemnat şi nu găseşti în tine voinţa de autodepăşire. Doar perseverenţa şi lupta pentru perfecţiune permit ordonarea şi reaşezarea inteligentă a minţii inovatoare, oferind o şansă aparte destinului creator.

Dintodeauna scopul ştiinţei a fost cunoaşterea, care a permis controlul naturii, dar în prezent ştiinţa şi tehnologia sunt deseori utilizate, din păcate şi în scopuri nedomestice şi antiecologice. Aceste creaţii „excentrice" trebuie scoase din competiţie şi stopate.

Vai de „neamul" care nu ştie să-şi aleagă liderii şi aceştia la rândul lor, nu respectă proprietatea intelectuală şi mai grav, nu permit distingerea autenticului de fals sau separarea adevărului de eroare!!!

O societate, oricât de avasată ar fi, dacă cheltuie mai mult pe coordonarea şi întreţinerea aparatului birocratic decît pe dezvoltarea învăţământului şi a cercetării, ajunge în precolaps, în starea de entropie maximă, frânată de propriile formule complexe ale unui management defectuos. Pentru a evita astfel de sisteme cu viitor nefast, trebuie să se schimbe radical prioritătile într-un context ecologic integrat, iar munca de educare şi de creaţie să fie stimulată în sensul creării condiţiilor optime de refacere a echilibrelor socio-economice şi pentru realizarea de sisteme de valori flexibile, uşor surmontabile. Viaţa a demonstrat că sistemele de valori şi cele etice nu sunt periferice faţă de produsele creaţiei tehnice sau artistice, dimpotrivă, primele două reprezintă forţa motrice ale celor din urmă.

România are nevoie astăzi, mai mult decât oricând, de un sistem social-economic echilibrat, adaptat cerinţelor şi condiţiilor proprii, pe fondul unui sistem politic pro-naţional coerent, care să permită dezvoltarea corespunzătoare a valorilor. Trebuie restaurat respectul pentru om, pentru şcoală şi educaţie, pentru valorile patrimoniului intelectual. Învăţământul şi cercetarea trebuie să ofere o perspectivă, dând şanse viitorului printr-o pregătire continuă şi cum mulţi recunosc, trebuie să redevină motorul societăţii, nu Cenuşăresele în care au fost transformate în ultiimi ani.

Este adevărat că lipsurile şi necazurile pot fi suportate şi mai ales îndepărtate prin „inteligenţă" şi că singura soluţie pe care o găsesc tinerii de astăzi este exodul spre alte ţinuturi mai prielnice, acolo unde cred că există „frumuseţea vieţii", dar care pentru mulţi devine „iluzia vieţii". Oare unde este mai bine ca acasă??? Fenomenul migrării ar trebui să fie considerat cel

mai dur efect primit de o guvernare şi nu privit pasiv sau mai grav, stimulat voit. România are nevoie de guvernanţi înţelepţi, care să permită punerea în valoare a potenţialului creator. A nu se uita că omul de creaţie are multă minte, dar şi suflet care trebuie stimulat. Creatorul este căutătorul perseverent al binelui şi nu merită să fie neglijat de societate şi să fie îngenunchеat de cei care elogiază ignoranţa.

Pe lângă aceste aspecte pe care trebuie să le suporte inventatorul român, după 1990, două au avut un impact negativ, considerate de unii inventatori anti-româneşti şi anume, taxele exagerate pentru brevetare introduse în baza Legii protecţiei invenţiilor, care au redus drastic numărul de dosare de brevetare, în perioada 1996-2000 înregistrându-se numărul cel mai mic de invenţii din ultimii 30 de ani şi criteriile minimale pentru abilitare în învăţământul superior şi cercetare, introduse în 2011, care au scos din competiţie foarte mulţi specialişti cu un potenţial de cercetare deosebit.

La ultimul Consiliu Ştiinţific al membrilor Forumului Inventatorilor Români din martie 2012, pe fondul agitării sindicatelor din învăţământul superior şi cercetare, s-au discutat grilele minimale de abilitare. Au fost formulate câteva soluţii punctuale pentru aceste grile, care să acopere complexitatea activităţilor academice de cercetare.

Prin adresele 391 din data de 16 februarie 2012, 406 şi 407 din 9 aprilie 2012 către Sindicatele din învăţământul superior, respectiv către conducerea UEFISCDI şi ANCS din Ministerul Educaţiei, Cercetării, Tineretului şi Sportului, a fost prezentat punctul de vedere al profesorilor universitari cu activitate de inventică meritorie, afiliaţi la Forumul Inventatorilor Români, redat în continuare:

«De la publicarea în M.O. a Ordinului Minstrului nr. 4478/23.06.2011, majoritatea ne punem întrebarea dacă standardele minimale au fost „impuse” de un grup restrâns sau au fost supuse unei dezbateri prin ***asociaţiile profesionale*** şi respectiv prin ***corpurile profesorale*** şi de ***experţi*** din universităţile şi institutele de cercetare cu tradiţie, aşa cum ar fi fost normal?

Un ordin sau o măsură care se ia la nivel naţional are nevoie de multă coerenţă, să nu permită speculaţii sau subterfugii, să ofere un sistem de evaluare clar şi adecvat pentru întrega plajă de activităţi academice (cercetare/proiectare/inovare/dezvoltare şi didactic).

Un profesor universitar, pe lângă performanţa ştiinţifică prin lucrări ISI, poate avea performanţă şi în alte activităţi academice, care nu au fost luate în seamă în actualul sistem de evaluare.

În acest sens, Adunarea Generală Consiliului Director al Forumului Inventatorilor Români, la propunerea profesorilor universitari afiliati au ajuns la următoarele concluzii:

- În evaluare ar trebui să fie luate ***toate revistele ISI***, pe cele ***trei categorii*** (cu scor relativ; cu factor de impact cu scor relativ zero şi respectiv cele indexate ISI fără factor de impact), pentru a încuraja ***dezvoltarea revistelor româneşti*** şi pe ***tinerii cercetători***, eliminând astfel diversele manipulari.

- Nu sunt corect evaluate ***monografiile, tratatele şi cursurile*** universitare prin edituri naţionale şi internaţionale (editurile naţionale ar trebui clasificate pe trei nivele: de interes internaţionale, de interes naţional, de interes regional).

- Nu sunt luate în evaluare ***brevetele de inventii***, cu toate că în descrierea panelurilor P1 si P2 acestea sunt menţionate, dar nu li se atribuie punctaj; invenţiile sunt prezentate în foarte multe baze de date internaţionale, din care două foarte importante: *Derwent Innovational Index* ce aparţine de *ISI Thomson*, unde sunt prezentate şi citările invenţiilor în reviste ISI şi în patente străine, apoi *ESPACENET*-ul cea mai utilizată bază de date în cercetare, fiind gratuită şi uşor de accesat.

Legat de brevetele de invenţie, a nu se uita contribuţia unor universitari, profesori de inventică, care au format zeci de tineri inventatori.

> *Amintim doar un singur profesor, cel mai puternic la ora actuala din Romania, conducator de doctorat, prof.univ.dr.ing. Dorel CERNOMAZU de la Univesitatea "Stefan cel Mare" din Suceava, la care fiecare doctorand la terminarea tezei are câte trei sau chiar mai multe inventii pe tematica doctoratului, iar profesorul, unul de marca in Europa, are peste 300 de inventii, fiind considerat inventatorul nr. 1 din România – Cum să neglijăm aşa activitate?*
>
> *De asemenea, considerăm că un brevet de invenţie este valoros atât prin partea financiară, cât şi prin* ***citarea acestuia în reviste ISI şi alte brevete străine****, unde formează baza de date pentru stadiul actual al cunoaşterii. Multe invenţii aduc şi*

contribuţii teoretice în formularea unor ***efecte şi principii de funcţionare noi****.*

- Nu sunt luate în evaluare ***proiecte de cercetare*** naţionale şi internaţionale, care ar trebui *grupate pe tipuri de programe şi cote valorice* şi nici *punctajul* obţinut în urma evaluării după finalizarea etapei sau a proiectului (se cunosc exemple: manageri care au gestionat în condiţii optime proiecte şi au obţinut rezultate cu calificativul maxim, fără a publica în jurnale cu scor relativ de influenţă peste 0,5 şi invers, cercetători cu foarte multe lucrări ISI cu scor mare, care au obţinut pentru anumite proiecte punctaje mici).

- Nu sunt luate în considerare ***citările în lucrări*** de specialitate (nu doar in reviste ISI), considerăm foarte importante: tezele de doctorat din strainatate, monografii, tratate, invenţii etc.

- Nu sunt luate în considerare ***recunoaşteri la manifestări internaţionale***: distincţii, ordine, premii si medalii, obţinute în urma unor jurizări sau evaluări de către consilii ştiinţifice.

- Nu se ia în considerare activitatea de ***dezvoltare instituţională*** (organizarea de laboratoare, ateliere, microproductie, instalatii etc.), care poate fi verificată şi semnată de conducerile instituţiilor. De asemenea, nu este luată în considerare ***dezvoltarea unor instituţii naţionale***, unele luate de la cota zero sau a unor ***specializări moderne la nivel de licenţă, master şi doctorat***.

- Nu este luată în considerare participarea în ***consilii ştiinţifice, jurii internaţionale şi comitete de organizare*** ale unor evenimente ştiinţifice internaţionale.

- Nu sunt luate în considerare calităţile de ***editor/reviewer*** în cadrul unor jurnale internaţionale şi a unor edituri.

- Nu sunt corect evaluate ***participările la manifestări internaţionale*** (pe cele patru nivele: invitat special, conferinta, comunicare, poster)

- Nu se încurajează ***lucrul în echipă*** şi în ***sisteme interdisciplinare*** (de obicei, conducătorii de doctorat nu sunt ***prim-autori***, oferind tinerilor posibilitatea de dezvoltare. Nu trebuie să se aducă prejudicii demnităţii celorlalţi coautori).

Actuala formă de evaluare incompletă este considerată de profesorii universitari inventatori agresivă şi speculativă, care protejează doar un segment redus de universitarii.

O altă problemă ridicată în cadrul asociaţiei noastre este faptul că lista prezentată de UEFISCDI (http://www.uefiscdi.gov.ro/UserFiles/File/CENAPOSS/istoric_Scor_Relativ_Influenta.xls) nu corespunde ca valori cu cele prezentate pe ISI Thompson, corect ar fi să se revină doar la ***Factorul de Impact***.

De asemenea, limitarea evaluării doar la ultimii 10 ani este un abuz, care aduce prejudicii profesorilor şi cercetătorilor cu vechime.»

În nici o ţară democratică nu se adoptă legi sau norme fără consultarea sau implicarea asociaţiilor profesionale şi a specialiştilor de marcă.

Anapoda, în ultimii 20 de ani, cei care au fost puşi să decidă soarta inventicii româneşti, au făcut-o în nume propriu, fără a se consulta cu performerii din domeniu, mai mult, fac parte dintre cei care nu au nimic cu inventica.

De multe ori, eu şi alţi inventatori suntem luaţi la întrebări destul de agresiv despre activitatea noastră de inventică, de către persoane care în viaţa lor nu au elaborat măcar o invenţie şi care nu cunosc sau nu simt frumuseţea creaţiei tehnologice.

Ca răspuns al profesorilor de inventică la aceste grile minimale, la extremă, de ce nu s-ar utiliza drept criterii minimale pentru abilitare, de exemplu, 10 inventii, cu un minim de 10 citări în patente străine sau în reviste ISI, căci imaginea în sistem internaţional este dată de nunărul şi importanţa citărilor. Oare este mai important scorul relativ de influenţă al revistelor în care se publică, sau imaginea autorului prin citări? În acest fel s-ar realiza aceeaşi grilă părtinitoare, care dă şansă unui segment foarte mic de universitari, doar celor cu performanţă în domeniul inventicii.

Paradoxal, minimalele nu pot fi contestate, ci doar constatate, chiar dacă sunt anumite încălcări ale normelor privind stimularea şi valorificarea unor forme de proprietate intelectuală sau se aduc prejudicii altor performanţe profesionale, contribuţiilor privind dezvoltarea instituţională etc. Coerenţa acestor minimale este de multe ori compromisă de erorile în verificarea corectă a unor citări prin sistemele acceptate ISI Thomson sau SCOPUS, cu atât mai mult prin Scholar Google sau altele des folosite sau indicate (de exemplu site-ul din Australia cu manifestările ştiinţifice, în care sunt monitorizate majoritatea celor din domeniul IT, site-ul KVK pentru monografiile cuprinse în bibliotecile europene etc.).

Durerea este că s-a ştiut de mult de aceste grile, dar nimeni nu a înaintat comentarii sau observaţii. Cu toate că Sindicatele din Învăţământul Superior s-au întrunit la Bucureşti pentru a aduce ameliorări bine justificate, întrucât viaţa unui universitar înseamnă nu numai lucrari ISI, ultimii 10 ani sau scor de infuenţă mai mare de 0.5, după aproximativ două luni, nici măcar o mişcare în domeniu.

Eu consider aceste norme ca fiind neacademice şi lipsite de etică (mai ales prin prejudiciul adus în ultimul an tinerilor cercetători şi seniorilor care au dezvoltat în România instituţii şi sisteme prioritare pentru stiinta romaneasca), fiind impus politic din raţuni financiare pe fond de criză, fără a avea acceptul sistemului academic naţional. Le consider speculative, deoarece activitatea unui universitar împlinit profesional şi cu o imagine internaţională, înseamnă cu mul mai mult decât lucrările ISI cu *scor relativ ajustat*/????/).

Cum ei s-au grăbit să elaboreze grile reprezentative doar pentru un segment foarte redus, ar trebui ca universităţile să le răspundă pe masură, fără a se lăsa desfiinţate din orgoliul unor aşa-zişi "performeri ISI-işti".

Eu toată viaţa am elaborat invenţii (peste 130 indexate ISI ca autor şi peste 400 ale tinerilor cu care am colaborat), apoi am condus peste 100 de proiecte (teme de cercetare), am dezvoltat specializări noi, microproducţie de materiale moderne şi multe altele, recunoscute nu numai în ţară ci şi în străinatate. Puteam în activitatea mea să mă rezum speculativ numai la lucrări publicate în reviste ISI, dar a trebuit să răspund la toate exigenţele impuse de instituţiile de învăţământ din care am facut parte.

Ar fi bizar să impun la rându-mi un set de grile care să mă reprezinte numai pe mine. Mă consider nedreptăţit după 35 de ani de activitate intensă, în care am facut performanţă în multe activităţi academice, fără a excela in lucrări ISI (cu toate că am peste 100), precum autorii acestor grile minimale.

Cei care au merite şi se simt frustraţi de actualele grile, ar trebui să răspundă pe masură şi să nu aştepte înduplecare de la cei puşi pe desfiinţarea valorilor şi tradiţiilor din cercetarea şi învăţământul superior românesc.

De asemenea, ca răspuns la întrebările invidioase la adresa inventatorilor ale celor dinafara activităţii de inventică, aş răspunde prin următoarele aspecte.

Oare de ce nu pot fi ceremonioase arta şi ştiinţa?, de ce sunt umilite şi batjocorite de prea-marii zilei, este o întrebare la care aşteaptă răspuns astăzi inventatorii din România. Prea mulţi sunt cei care replică prin întrebări: ce tot atâtea saloane?, ce tot atâtea medalii?....Să nu uităm că inventatorul este om, şi că aprecierea celor din jur joacă un rol important în dinamica şi potenţialul său de creaţie.

La 200 de brevete, unul dacă se aplică în practică, este un lucru deosebit. Să nu uităm că pentru a realiza un salt inovaţional este necesar să se parcurgă o serie de trepte, un lanţ inovaţional. Invenţia performantă vine după un drum lung şi anevoios de cercetare-dezvoltare şi fără brevetarea sau patentarea fiecărei trepte intermediare, nu se poate realiza o protecţie bună.

În Japonia, dacă la 3000 de brevete se obţine una performantă sau revoluţionară cum spun ei, s-a realizat un coeficient normal de absorbţie a noilor tehnologii, a ideelor novatoare.

Se ştie că foarte multe invenţii au dezvoltat principii noi de funcţionare, un exemplu îmi vine în minte acum „teoria sonicităţii" a lui Gogu CONSTANTINESCU, un mare inventator român, care nu s-a împlinit în patria lui, ci în Anglia, unde la numai 26 de ani devine director tehnic la British Aerospace din Bristol şi ale cărui invenţii, multe încă sunt păstrate la „strict secret", lucru ce l-a nemulţumit pe marele creator. Să nu uităm că „teoria sonicităţii" a stat la baza unei noi ştiinţe, cu multe aplicaţii practice, printre care şi forajul sonic al inventatorului Ion BAZGAN, confiscat de americani după al doilea război mondial (România nefiind considerată ţară beligerantă în urma Tratatului de Pace încheiat în 1945), privând astfel inventatorul şi statul român de veniturile obţinute din aplicarea lor atât în America, cât şi în Rusia.

Sunt conştient că un singur glas se aude greu, mai ales atunci când nu se vrea să fie auzit de cei care gestionează cercetarea românească.

Efortul de a organiza sub egida aceiaşi manifestări a mai multor saloane specializate pe diversele activităţi de creativitate: ştiinţifică, tehnologică, literară şi artistică este explicat prin dorinţa de a demonstra că oricare ar fi forma de creativitate, înseamnă pe lângă talent şi genă, multă muncă, pasiune, stăruinţă, abnegaţie etc. Mai mult, aceasta vrea să atragă atenţia asupra faptului că activitatea de inventică ar trebui să fie răsplătită în mod diferenţiat prin finanţare de la buget şi nu taxată pentru protecţie.

Se ştie că după 1990, OSIM-ul, singura instituţie guvernamentală cu activitate de brevetare a invenţiilor, în încercarea de a găsi noi surse de

finanţare, a introdus după modelul unor agenţii de patentare din Europa, taxe de brevetare foarte mari, fără a ţine cont de diferenţele socio-economice ale ţării noastre în raport cu ţările dezvoltate, cum ar fi: Elveţia, Germania, Austria, Franţa etc. şi de aspectele legate de tradiţie, de resurse şi de specificitatea activităţilor autohtone. La noi, creativitatea tehnologică a avut anumite forme şi nivele de manifestare legate de industriile fostului stat socialist, care după 1990 au dispărut sau au fost înlocuite cu sisteme private, cu tehnologii aşa-zis „performante" din străinătate, de fapt majoritatea provenind de la „second hand", care nu mai permit absorbţia de invenţii noi.

Este adevărat, se pot introduce taxe pentru mărci, desene şi modele industriale, care sunt plătite de societăţi comerciale, dar nu trebuie exagerat când este vorba de invenţii. Taxele ar trebui să acopere doar cheltuielile de brevetare şi publicare, cele de protecţie căzând în sarcina aplicantului. De aici şi necesitatea protecţiei diferenţiate a proprietăţii intelectuale (revendicarea gradului de noutate prin certificat de autor sau brevetul de invenţie) de cea industrială (acoperită juridic prin licenţa de aplicare – patentul).

Mult i-a trebuit conducerii OSIM să înţeleagă că inventatorii români nu au puterea financiară să poată acoperi taxele de brevetare. Acestea se pot aplica în cazul invenţiilor realizate prin contract de cesiune sau prin misiune inventivă. Inventatorii artizani, profesorii de inventică (care formează inventatori), dar şi elevii, studenţii şi pensionarii ar trebui să fie scutiţi de taxe. Celorlalţi inventatori, în afara celor angajaţi prin contracte ferme pe inventică, ar trebui să li se aplice aceleaşi cote de reducere a taxelor (25%) ca şi pentru universităţi şi ONG-uri.

Nu doresc să continui discuţiile pe această temă, dar este de datoria noastra să nu sfidăm inventatorii de elită, profesorii de inventică şi anumite şcoli doctorale, aş reaminti-o pe cea mai puternică la ora actuală din România, Şcola Doctorală condusă de prof.univ.dr.ing. Dorel

CIORNOMAZU de la Univesitatea "Ştefan cel Mare" din Suceava, unde fiecare doctorand la terminarea tezei are câte trei sau chiar mai multe invenţii.

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TOOL FOR COMPARATIVE ANALYSIS OF THE US VETERANS AND GENERAL POPULATION IN BUSINESS – ECONOMIC AND SOCIOLOGIC IMPLICATIONS

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Abstract.
The more than 20 millions veterans in US represent a significant percentage of the active population. I report on a comparative analysis of the veterans and general population business ownership and on a software application intended to help veterans in their orientation toward business. The statistic results show that at older ages, veterans seem to be relatively more numerous entrepreneurs than the general population, but it is not clear if the cause is qualities specific to them, government support, need for late retirement, or a mixture of these factors. A visual analysis tool is described that helps performing a fast comparison between various groups of veterans.

Keywords: business, entrepreneurship, veterans, US Census Bureau, distribution, correlation, disabled veterans

1. INTRODUCTION

This paper reports on an analysis of the involvement of veterans in the business in comparison with the overall population of US. I derive several conclusions on the economic and social role of the veterans in contemporary US economy and society. Of special interest in this study are a series of questions related to US veteran future after retirement and to the impact of the veterans on US economy and society after leaving the service. I found that, in some respect, their impact is, on average, higher than for the overall population, meaning that they bring a double service to US, in active service and as entrepreneurs. In addition, I found that disabled veterans are a very active group of entrepreneurs among veterans.

What the analysis undoubtedly shows is that the veterans preserve their initiative independence and a high success rate, compared to the average population, in their older years. If, according to Mauzy and Harriman, in their book “Creativity, Inc. Building an Inventive Organization” [1],

creativity is the main feature of succeeding entrepreneurs, then it seems that veterans preserve an impressive creativity at older ages, as the data discussed in this paper shows.

Several studies have recently addressed the entrepreneurship of veterans. Beyond the analyses on the site of the Department of Veteran Affairs [2], the studies by Hope, Oh, and Mackin [3] and by Waldman Associates and REDA International [4] are thorough analyses of the veterans' entrepreneurship, on the factors influencing it, and on the veterans' business ownership. Stevenson and Lundström, in their extensive sturdy on almost 500 pages [5], compare how ten national economies deal with various groups to support their entrepreneurship, including veterans. They find that US is in the forefront in supporting this group. Regarding the qualities that favor veteran entrepreneurship, I cite from [6], which gives the statistics of hiring managers' opinions (HR from companies that hired veterans) on the reasons for hiring veterans: "veterans' ability to be team members (74 percent), a disciplined approach to work (73 percent), leadership skills (66 percent), respect and integrity (64 percent), and ability to perform under pressure (62 percent)." Several other studies, as [7] and [8] were devoted to disabled veterans.

The intended audience of this analysis includes economists interested in entrepreneurship, researchers in sociology and creativity theory, veterans desiring to start a business, and government officials designing grants to help veterans start and maintain businesses. Veterans may learn from this study on their potential, on the average results in business of their fellows, and on the opportunities after release from active service. Economists may draw conclusions on the impact of veterans over the whole economy. Sociologists could use this study for better framing the role of veterans in the contemporary society.

2. ANALYSIS

In order to explore how veterans in business compare to the general population in terms of entrepreneurship, I propose the following study questions: (1) How does the age distribution of veteran owners vs. the age

distribution of general population owners compare? (2) How do the age distributions of veteran owners correlate with those of service-disabled veterans? (3) How many more hours a week do veterans work as compared to the general population? (4) How does the ethnicity distribution of veteran business owners compare to the general population? (5) What conclusions can be derived for the economic and social decision factors and for the veterans themselves. To answer these questions, I built a small application for visualization of the statistics results based on the data on the US Census Bureau site. The description of the tool is provided in Section 3. Figure 1 shows a snapshot of a screen of the application. All figures in this paper are screen snapshots from the application, which are modified to make them readable on paper.

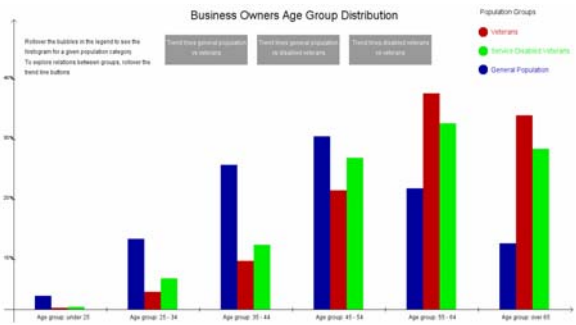

Fig. 1. Screenshot of the application for the age distribution of the business owners

1. Regarding the first question, on how does the age distribution of veteran owners vs. the age distribution of general population owners compare, I found a weak correlation between the veteran population (including its subset of service-disabled veterans) and the general population. Veterans tended to start businesses at later ages, which can be explained by the age of retirement from military service. Does this mean that veterans are at a disadvantage? The question is further explored in the paragraph numbered as **3**.

Regarding the comparison of the veterans' age distribution and that of the general population (see Figures 2 and 3), I determined a correlation

factor of the distributions of 0.466 between the age distribution of the general population and that of veterans. A weak correlation factor shows that the veteran population is significantly different from the general population in this respect. The best-fit line shows that there is a very good correlation between the veteran and the disabled veteran population groups up until the age of 54-55. The disabled veterans group is more active in businesses after the age of 54-55 than the overall veteran population.

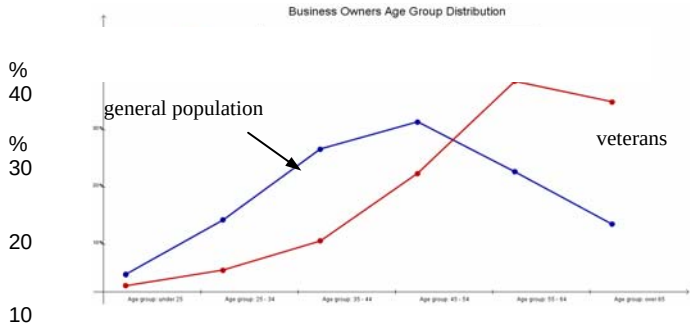

Fig.

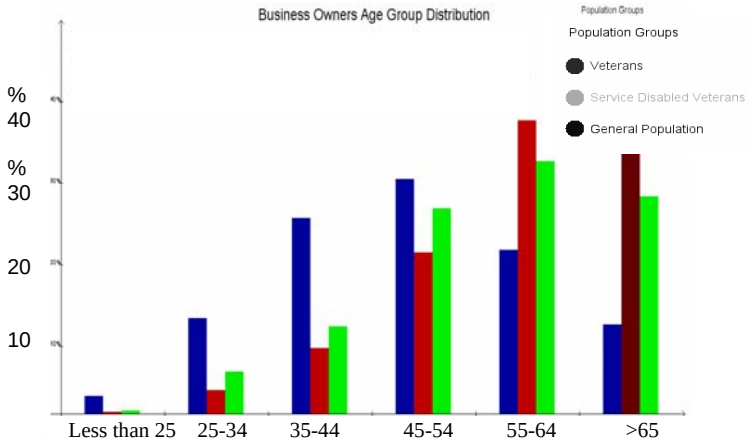

Fig. 3. Distributions of the three populations according to age groups

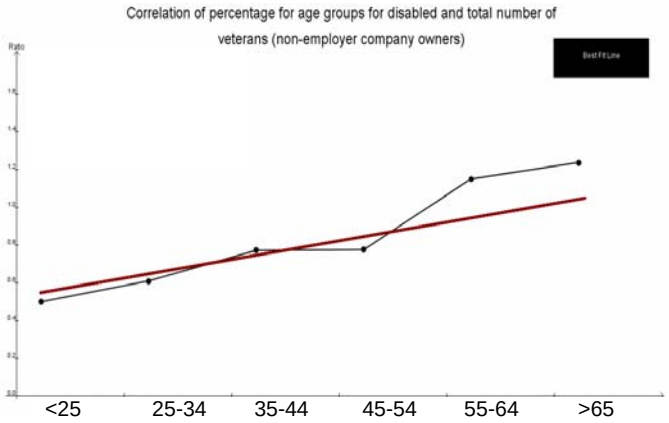

Fig. 4. Correlation of the percentage for age groups for the disabled and the total number of veterans, for non-employer company owners.

2. Concerning the question how do the age distributions of veteran owners correlate with those of service-disabled veterans, the application presented herein performs the correlations and shows the results to the user on the screen (Figure 4). The correlation is computed according to the expression of the correlation coefficient, $C_{xy} = \dfrac{\overline{xy}}{\sigma_x \sigma_y}$, where x and y denote the distributions of the two populations that are correlated. For example, taking into account the age groups, the correlation formula becomes

$$C_{xy} = \frac{(1/N)\sum_{k=1}^{N} P_k^{(g)} P_k^{(v)}}{\sigma_g \sigma_v} \qquad (1)$$

In (1), $P_k^{(g)}$ denotes the distribution for the general population and $P_k^{(v)}$ denotes the distribution for the veteran population. The number of bins, N, is the same for both distributions.

There is a strong, but not perfect correlation between the service-disabled veteran population and the veteran population in general. The disabled veteran group is more active in businesses after the age of 54-55 than the veteran population in general. This fact can be used to create

specific business start-up grants for disabled veterans above the age of 50. The values of the correlation coefficients are given in Table 1.

TABLE 1. Correlation coefficients for age distribution of business owners in the three populations (general population, veterans, and disabled veterans)

General population vs. veterans	General population vs. disabled veterans	Veterans vs. disabled veterans
0.446	**0.646**	**0.969**

Notice in Figure 2 that there is a 10 years difference between the maxima on the distributions of the general population and the veterans with respect to business ownership. This feature might be partly explained by the delay in starting businesses by the veterans.

3. While the result answering our first question may imply that veterans are at a disadvantage (since they start businesses later and retire later), this is not completely true. With reference to the question how many more hours a week do veterans work as compared to the general population, the findings are as follows. Looking from the perspective of the average number of work hours spent per week (see Figure 5), veterans spend an equivalent amount as other business-owners from the general population (26.5 hours/week). This means that they are not placed at a disadvantage in terms of amount of work. According to the result supporting the answer to question #1, that veterans retire later, remains a fact that is relevant in retirement benefits plans and for the action the government may take to support veterans in business. I found that the correlation coefficient between the work hours per week for veterans and the general population is 0.998, which means that there is no significant difference between the two populations in this respect.

There are no large differences between the number of hours worked per week by the overall populations of service-disabled veterans, veterans, and general population. Small differences occur only for specific age groups, especially for disabled veterans, who are relatively the most numerous to extend the work for more than 60 hours per week.

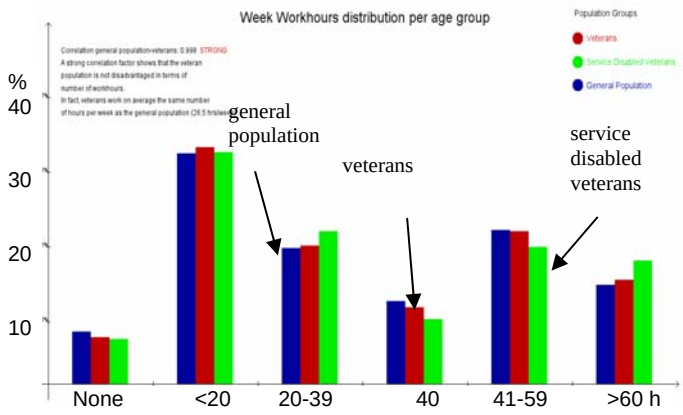

Fig. 5. Comparison of the distribution per age group of the average number of hours worked per week by the general population, the veterans, and the service disabled veterans

4. Regarding the question on how does the ethnicity distribution of veteran business owners compare to the general population (see Figure 6), the results show that the least represented minority among veteran business owners is Hawaiian-American. A finding is that service-disabled African-American and Asian-American disabled veterans tend to be more active in creating and preserving businesses than the corresponding minority ethnicities in other population groups (the general population and the overall veteran population). This finding can be used to direct government business start-up grants to service-disabled veterans from the respective minorities.

Unexpectedly, in all minorities, the disabled veterans are significantly more active than the average veteran populations. The highest rate of relative amount of increase is found for African-American, where the percentage of disabled veteran owners is twice that of non-disabled veteran owners, as well as of the overall population. Almost the same situation occurs for Amero-Indians and for native Hawaiian, but for Asian-American, the veteran owners are three fold fewer than the general population.

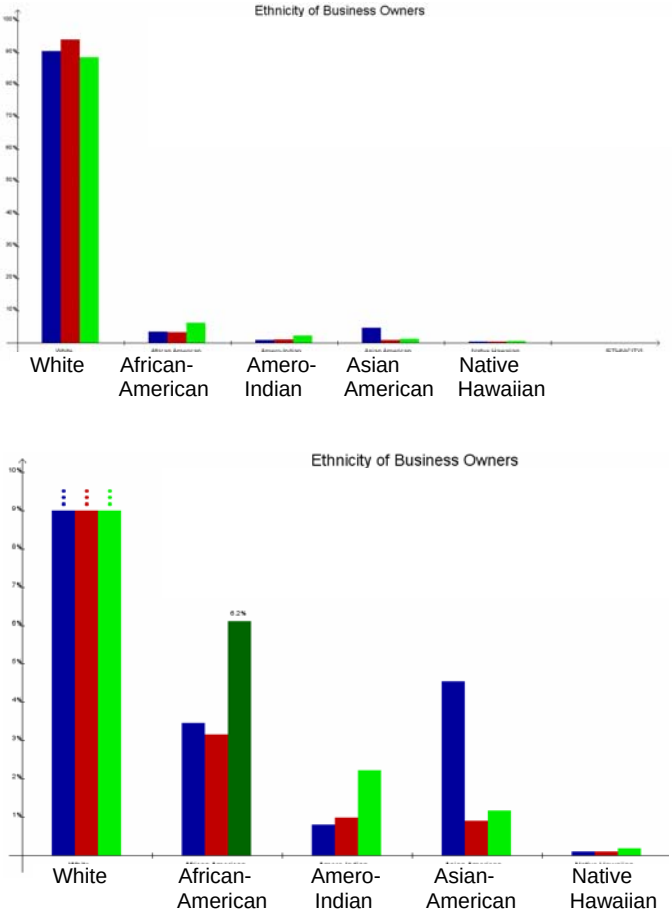

Fig. 6. Ethnicity of business owners for the three populations: general US population, veterans, and service disabled veterans

The visualization of the ethnicity distribution of veteran business owners and the results on how this distribution compares to the general population (Figure 6) is aimed both at government and veteran audiences. Government grants to facilitate the development of businesses by minorities in the veteran population can be based on the findings resulting from this visualization. This panel is a global view, which shows that about 90% of

both general population business owners and veteran business owners is of white ethnicity. Since the difference between ethnicity percentages is in one order of magnitude, a zoom in functionality is added to allow the visualization only of the minority percentages.

3. APPLICATION DESCRIPTION

The application is a Java program written by the author, with visualizations exhibiting a consistent color-coding and coordinate systems. The application automatically accesses the web pages and the tables with the data at the National Statistics US Bureau. This design offers a visual analysis aimed to pinpoint differences between the general population and veteran business owners, in view of helping veterans to understand trends and possible specificities of their category. The final purpose is to help the veterans to successfully develop their business. The visualization is structured around the main issues I aim to clarify, each button providing a synthetic answer to the main questions asked.

The users are allowed a large freedom in interacting with the visualization. They can rollover any of the bars or bubbles that represent data; the user can visualize trendlines in some datasets, or zoom in. All buttons are activated through clicking over them. The visualization tool also provides correlation factors for some datasets, which together with trend lines aid in drawing conclusions about the veteran population group. The histogram for a given population group is available by rolling over the bubble representing the group in the legend of the visualization (upper-right corner for the histogram-type visualizations). The data source is constituted by the US Census Bureau, which provides the set of tables (but with no visualizations) at http://www.census.gov/econ/sbo/index.html.

The application runs at a resolution of 1280×800. In order to run it in these parameters, one should use the application in its applet form. The buttons are all activated through clicking; all data-representing graphical marks (such as bars, points represented as small diameter bubbles), as well as the bubbles in the legend to the histograms are accessible through rollover. The zoomed in view is at a scale of 0-10%. This allows the view of the minority percentages. The user may rollover each bar to find its

percentage. The three dots above the bars corresponding to the white ethnicity mean that the bars are continued above 10% (rolling over them will still show their percentage). The application is easy to transpose to other social categories of entrepreneurs, provided that statistical data are available in tabular form on the site of US Census Bureau or on a similar site. I believe that the application can be a useful tool for decision makers in economy and sociology.

4. DISCUSSION AND CONCLUSIONS

Because of the large population in the statistics of the Census Bureau, the degrees of confidence in the conclusions I derived are very high (>99.9%). The processed data in this paper are from 2009 Census Bureau data.

The somewhat low number of studies devoted to the veterans' contribution to US economy and to veterans' entrepreneurship is somewhat surprising, because veterans represent an important component of US society, moreover because they have an active and important role in US economy. As this study shows, the veterans seem to be, in several respects, more intrepid than the average of the population during their older years. Service-Disabled Veterans tend to be more involved in starting businesses and preserving them than the corresponding minority ethnicities in other population groups. Also, the data show that there are strong variations of the business ownership between ethnic groups

An exciting question derived from this study is if it is there a measure of higher entrepreneurial, possibly technical creativity in the population of veterans, or are there social factors that can explain the higher than average entrepreneurship of the veterans, at older ages.

If we follow the main idea in the article by Mitchell, Bailey, and Mitchell [9], taking into account the success many of the veterans show in establishing and maintaining their own business up to older years, we derive that veterans have a high ability of "metacognitive thinking, … self-reflection, understanding, and control".

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A NEW FLUORESCENT PROBE FOR TOXIC CYANIDES SENSING IN AQUEOUS MEDIA

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Abstract: *A newly synthesized naphthalimide derivative was studied as a fluorescent sensor for free and weak acid dissociable cyanide in 100 % aqueous media. The response to the cyanide is based on a ligand displacement reaction between cyanide and ferric-naphthalimide derivative complex. In 100 % aqueous solutions of the naphthalimide derivate, the presence of Fe^{3+} induces a strong and increasing fluorescent emission. A quenching of fluorescence was observed upon addition of free cyanide or cuprous-cyanide complex.*

Keywords: *Naphthalimide, Free cyanide, WAD cyanide, Fluorescence*

1. Introduction

Cyanide is one of the most toxic inorganic substances. It is emitted into the environment mainly with industrial waste water. The requirements of Water Authorities regarding cyanide discharge are getting more and more stringent every year. At the same time the industrial sources of cyanide contamination are continuously increasing in number. The annual production of KCN is about 1.4 million tons and 13 % of it is used in refining metallurgical processes. Although the cyanide-containing water discharge is strictly regulated and pre-treatment procedures are strongly recommended, some industrial accidents have been reported. A deferential approach to detoxification has to be applied so that the ecological equilibrium will not to be disturbed at a large scale. Quickly available and highly reliable information about cyanide contamination is required.

The specificity of cyanide as a pollutant is of special concern. From environmental point of view, cyanide-containing substances have different toxicity and environmental fate. Hence, species specific information is needed [1]. From analytical perspective, the cyanide content quantification depends on the analytical method used [2]. Considering the great diversity of toxicity that cyanide species exhibit, cyanide pollutants have been officially classified into three groups: A) free cyanide - including HCN, alkaline and alkaline earth cyanides; B) weak acid dissociable cyanide (WAD) - a collective term for free cyanide and metal-cyanide complexes $Ag(CN)_2^-$, $Cu(CN)_4^{3-}$, $Cd(CN)_4^{2-}$, $Zn(CN)_4^{2-}$, $Hg(CN)_4^{2-}$,

$Ni(CN)_4^{2-}$) which easily release HCN under slightly acidic environmental conditions; and C) total cyanide - each potential source of HCN regardless of its origin [3]. The term "cyanide" refers to all CN groups that can be determined analytically as cyanide ion (CN^-) via spectrometric or electrochemical measurements, usually following appropriate sample pre-treatment to release CN^- [4].

The Environmental Protection Agencies have imposed maximum contaminant levels (MLC) for cyanide discharge into the environment. The MLC for WAD cyanide vary from 0.05 to 0.07 μg/l for drinking water and in the range between 200-500 μg/l for waste water [5]. The MCL for total cyanide is much higher – 1 mg/l. The group of WAD cyanide has been a subject of special consideration as the assessment of environmental risk and efficiency of detoxification procedures depend on its analytical quantification.

Fluorescence spectroscopy has become a powerful tool for sensing and imaging trace amounts of pollutants because of its simplicity and sensitivity [6]. In the past few years, a variety of colorimetric and fluorescent probes for cyanide have been reported. Nevertheless, it is not easy to develop cyanide probes that are operable in water. The charged cyanide anion has high solvation in water. Thus, it should be desolvated from the surrounding water molecules for the anion to combine with an appropriate probe. Generally, the thermodynamic factor, particularly the enthalpy, for the cyanide-probe complex formation is not favorable for reversible chemosensors [7]. To overcome the enthalpic cost for the cyanide-probe complexation, two novel strategies are utilized for researchers who try to develop luminescent probes for the toxic cyanide anions in aqueous solution [8-10]. One is to employ the innate nucleophilicity of cyanide anions. The strong nucleophilicity of cyanide will make the cyanide-probe complex more feasible and often work as an irreversible probe, a reaction-based chemodosimeter. In recent years, a variety of fluorescent probes for the cyanide have been reported based on the nucleophilic reaction of cyanide to carbonyl or conjugated enone groups [11-16]. These types of probe designs take advantage of the nucleophilic character of the cyanide ion so that they induce a CN-specific response and exhibit little competition from the other analytes in aqueous media. The other is to employ the complexation ability of cyanide to a transition metal ion, which may compensate for the enthalpic cost of the water desolvation during the cyanide-probe complexation. Recently a number of fluorogenic cyanide sensors that utilize the strong affinity of cyanide to transition metals, particularly to Cu^{2+}, have been reported [17-20]. In these systems, addition of Cu^{2+} to fluorescent compounds, such as fluorescein derivatives,

cause significant fluorescence quenching, which is then reversed by the addition of cyanide, resulting in an 'off-on' type sensing system. Other researchers have also employed the use of boradiazaindacene (BODIPY)-derivatives, where the ability of Cu^{2+} ions to quench the fluorescence of a BODIPY-dipicolylamine derivative resulted in a 'turn-off-on' sensor, and detection of cyanide ions was reported as low as 20.0 μM [19]. Similarly, the Cu^{2+} displacement approach has been reported in a ratiometric fluorescent and colorimetric sensor, utilizing 4,5-disubstituted-1,8-naphthalamide as the receptor, where intramolecular charge transfer and deprotonation mechanisms were demonstrated in sensing cyanide ions in 100 % aqueous solution [20].

This report presents the results of the study of dihydroimidazonaphthalimide (DHIN) based fluorophore as a cyanide chemosensor acting via ligand displacement mechanism. As the main goal of our work is to develop a cyanide fluorescent probe not only for free, but also for weak acid-dissociable cyanide, the Fe^{3+}-fluorophore complex was obtained and studied as a WAD cyanide sensor.

2. Materials and methods

The fluorophore - dihydroimidazonaphthalimide (DHIN), was synthesized in the Laboratory of Organic Synthesis at University of Chemical Technology, Sofia, Bulgaria. All reactive used were of analytical grade. The working solutions were prepared daily by dissolving exactly weighted compounds in distilled water. The Fe^{3+}-DHIN complex was obtained by mixing aqueous solutions of DHIN and freshly prepared $Fe(NO_3)_3$ solution at 1:1 molar ratio at room temperature.

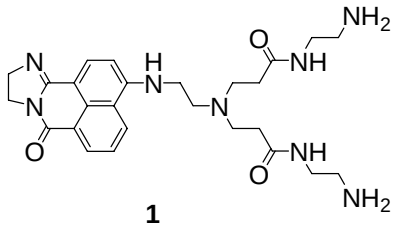
Potassium cyanide stock solution was standardized by silver nitrate titration. The stock solutions of $Cu(CN)_4^{3-}$ and $Hg(CN)_4^{2-}$ were prepared by exactly weighting of CuCN and $Hg(CN)_2$ and mixing with stoichiometric quantity of KCN solution in 10^{-2} M NaOH. Working solutions of CN^- were prepared by appropriate dilution with 10^{-2} M NaOH. Fluorescence emission spectra were obtained using Perkin Elmer LS55 spectrofluorimeter.

3. Results and Discussion

3.1 Synthesis of the fluorogenic compound

A novel compound was prepared in two steps as following: an yellow-green emitting intermediate was obtained by refluxing of 4-bromo-1,8-naphthalic anhydride in ethylenediamine. Then the intermediate was converted in the desired switch by exhaustive Michael addition in excess of

methyl acrylate, followed by exhaustive amidation of the resulting ester with a large excess of ethylenediamine to afford the dye: dihydroimidazonaphthalimide (DHIN) (scheme **1)** with reactive amine groups of its periphery:



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Scheme 1.

3.2. Fluorescence ability of the synthesized dye

Preliminary experiments showed that the dye (DHIN) is well dissolved in water and forms labile complexes with some metal ions. The fluorescence of the DHIN is quenched by the photoinduced electron transfer (PET) between the receptor and the fluorophore parts of the dye. However, in the presence of a guest, which binds to the receptor engaging its lone pair of electrons, PET communication between the receptor and the fluorophore is isolated and fluorescence of the system is recovered [21]. The DHIN alone showed low fluorescence intensity, due to PET quenching (Figure 1, curve 1). As can be seen from Figure 1 (curves 2-4), the fluorescence intensity increases upon addition of Fe^{3+} solution. The presence of a metal ion was signaled by fluorescence enhancement of the system. This effect was attributed to the binding of metal, which disallows the PET in the molecule. The changes were of such magnitude that they can be considered as representing two different "states", where the fluorescence emission is "switched off" in free from and "switched on" in complexed form. Due to these properties of DHIN, it was chosen to study as a cyanide sensor based on ligand displacement mechanism. Moreover, the complex was well dissolved in water and was stable in alkaline medium (10^{-2} M NaOH).

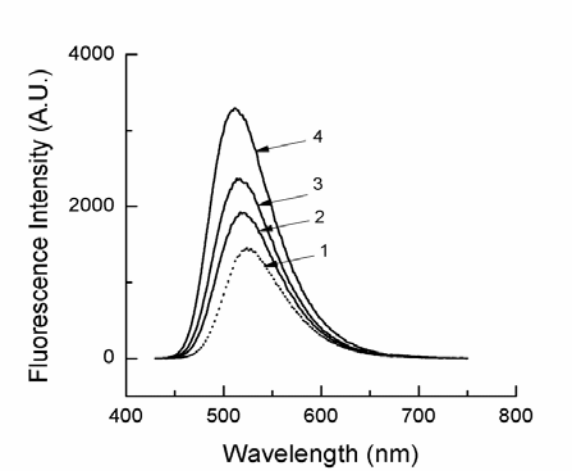

Figure 1. Fluorescent response of the proposed sensor (DHIN) to ferric ion at different concentrations: (1) DHIN in 10^{-2} M NaOH; (2) DHIN + $1x10^{-6}$ M Fe^{3+}; (3) DHIN + $2x10^{-6}$ M Fe^{3+}; (4) DHIN + $4x10^{-6}$ M Fe^{3+}

3.3 Free and WAD cyanide fluorescent sensor

The WAD cyanide sensor based on ligand displacement mechanism has to respond to two main requirements: first, the fluorogenic compound has to bind metal ions and formed complexes have to be labile in alkaline media, and second, the liberation of metal ion from the complex upon addition of cyanide has to change the fluorescence properties of the sensor system. Additionally, the metal-probe complex has to be stable enough in aqueous media to ensure reproducible fluorescent signal, but labile enough to participate in ligand exchange reaction in the presence of cyanide ions. Moreover, the lability of metal-probe complex has to be greater than the lability of WAD cyanide complexes, so that the ligand exchange may occur. Considering this conditions, the ferric - DHIN complex was chosen to be tested as a WAD cyanide sensor.

To study the effect of cyanide on the fluorescence ability of Fe^{3+}-DHIN complex, different aliquots of cyanide standard solution were added to aqueous solution of Fe^{3+} - DHIN complex. A decreasing of the fluorescence intensity was observed. The extent of decreasing was proportional to the increasing of cyanide concentration (Figure 2). The changes in the fluorescence intensity can be used as an analytical signal for cyanide quantification. Hence, Fe^{3+} - DHIN complex is a potential sensor for free cyanide having the advantage to work in 100 % aqueous media.

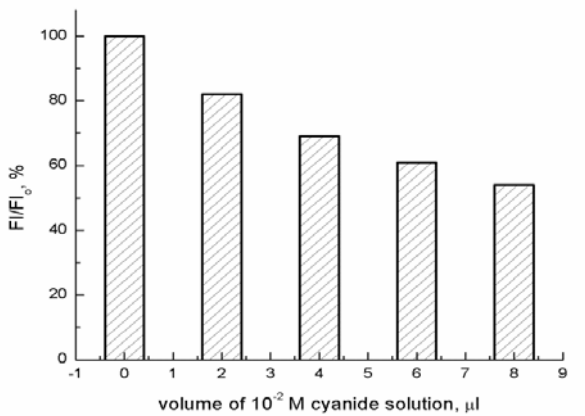

Figure 2. Relative fluorescence intensity DHIN-Fe^{3+} complex after addition of different volumes of 10^{-2} M cyanide solution.

From the environmental point of view, it is important not only to sense the free cyanide, but also WAD metal-cyanide complexes. The Fe^{3+}-DHIN complex was tested for response to copper-cyanide complex. As can be seen from Figure 3, the fluorescence intensity decrease in the presence of $Cu(CN)_4^{3-}$ in the same manner as in the presence of CN^-. The changes in the fluorescence can be related to ligand displacement reaction and formation of $Fe(CN)_n^{3-n}$ complexes and free DHIN. Thus, the ferric-DHIN complex can be used as a WAD cyanide sensor in aqueous media.

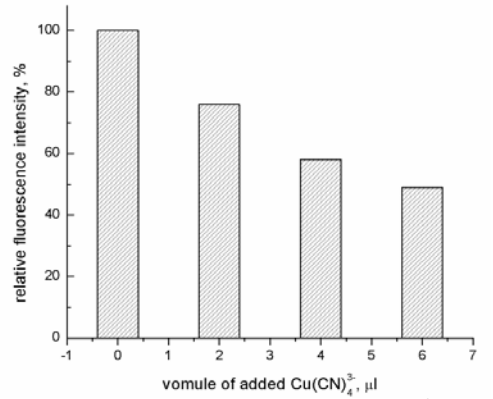

Figure 3. Relative fluorescence intensity of DHIN-Fe^{3+} complex in 10^{-2} M NaOH after the addition of different volumes of 10^{-3} M $Cu(CN)_4^{3-}$.

4. Conclusions

The described cyanide sensing system uses a newly synthesized naphthalimide based fluorophore. The cyanide response of the probe is based on ligand exchange between ferric-fluorophore complex and free or complexed cyanide. Although preliminary, these results are encouraging to develop a new chemosensor for WAD cyanide working in 100 % aqueous media.

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STUDY OF AlN LAYERS DEPOSITED ON Si BY TRANSPORT CHEMICAL REACTIONS AT NUCLEARIZATION STAGE

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Abstract: Thin AlN layers of the order of a half of micrometer thickness are grown upon Silicon by HVPE (Hydride Vapor Phase Epitaxy) method. The layers are investigated by atomic force microscopy (AFM) methods. At the stage of nucleation, the newly formed phase of AlN is a group of dispersed particles, statistically arranged on the surface of silicon. Two mechanisms are shown to increase the layer in the process of transition from discrete to continuous layer formation stage. It is demonstrated the possibility of new formed layer relief description in a polynomial approximation, whose arguments are elementary Gaussian functions that describe the shape of each newly formed granule.
Key words: AlN, Si, GaN, HVPE, AFM, dispersed particls.

1. Introduction

Currently, the AlN, GaN, InN compounds play a decisive role in the production of luminescent diodes and lasers throughout the visible spectrum. They can also have prospective applications in developing of high power electronic devices, capable of operating at high frequencies and higher temperatures in aggressive environments and nuclear radiation. Appropriate devices are usually made on heterogeneous Al_2O_3, SiC substrates, which are expensive and not available of necessary size, and have inappropriate electrical and thermal properties. Therefore replacing them with other cheaper and more accessible substrates, with proper electrical, thermal, mechanical and thermodynamic properties is a necessity in the current semiconductor technology development.

A material available for applications, which corresponds in part to these requirements, is considered silicon. Silicon possesses the required crystallographic, mechanical, thermal, thermodynamic and electrical properties. It is relatively cheap and accessible as substrate of diameter up to 300 mm, allowing obtaining multiple devices in a single technological process. In addition, the thermal conductivity of silicon (~ 100 W/(m·K)) being higher than that of sapphire (~ 50 W/(m·K)), it will increase the operational safety of devices.

However, using of silicon as a substrate in the epitaxy technology with nitrides of aluminum, gallium and indium, faces many obstacles. The main of them is due to mechanical stresses at the layer-substrate interface, generated by substantial discrepancy between the parameters of crystalline lattice (~ 40%) and between the coefficients of thermal expansion (~ 60%) of nitrides and silicon. These stresses generate structural defects at the interface of layers and can also cause a mechanical damage of layers. To overcome this obstacle, several technological processes are applied, including the use of structures with buffer layers and multi-layers (inter layers) inserted between the substrate and the corresponding compound.

This paper is devoted to the study of AlN buffer layers used in epitaxial growth of gallium nitride on silicon. In GaN/Si epitaxy these layers have several functions: a) barrier, which hampers the diffusion of substrate silicon into GaN layer, b) efficient conductor of heat, c) electrical insulator, d) partial compensation of mechanical stresses between the GaN layer and Si. These functions can be performed at certain parameters of layers. If the layer thickness is less than ~ 50 nm, the barrier effect is compromised. At high temperatures silicon enters the GaN layer due to diffusion and at the interface there appears drops of Ga:Si eutectic as a result of substitution of nitrogen by the silicon from the GaN layer deposited, and the deposited layers become imperfect. The AlN layer thickness should also not exceed certain values (~ 500 nm), else the effect of accommodating of the GaN layer in the silicon lattice will be reduced and GaN layers will become polycrystalline.

According to contemporary concepts of first degree phase transitions, the growth of crystalline layers occurs in several stages: nucleation; evolution of newly formed granules; interaction between granules; interaction between granules and the environment, etc. [1, 2]. The initial stages of nucleation of granules, and of the newly formed phase transition from the discrete stage to the stage of granules annihilation, and of continuous layer formation, play a decisive role in further evolving of the newly formed layers and obtaining of epitaxial layers.

In [3] we presented the results of research performed by the methods SEM (Scanning Electron Microscopy) and Raman spectroscopy of properties of AlN layers deposited on silicon in the temperature range 800-1100 ^{o}C. It was established that the layers are structured and mechanically stressed in the substrate plane. There will be presented below the results of AFM research of layers obtained by HVPE method at the stage of continuous layer formation.

2. Experimental method

Growth of AlN layers on Si substrate was performed by means of HVPE chemical transport reactions in a quartz reactor placed horizontally at atmospheric pressure. The hydrogen purified with palladium filter was used as transport gas. As precursors were consumed ammonia, hydrogen chloride and Al (99.999%). The H_2O, O_2, CO_2, CO impurities were further removed from ammonia and hydrogen chloride using NUPURE CORPORATION, MODEL 600 company filters. Both the flow of hydrogen chloride (HCl) in aluminum pipes and reactor corrosion flow were dissolved in 200 smlpm H_2. Total consumption of hydrogen was 4.8 slpm, and that of ammonia 2.4 slpm. Consumption of HCl was about 5 smlpm at layers deposition, and ~ 50-100 smlpm at corrosion. During the deposition the substrates were rotated by a hydrogen flow of ~ 1 slpm at a rate of ~100 rev/min.

The thermal profile of the reactor was provided with a resistive heater. The Al source temperature was constant, around 1120 K. The deposition temperature (1373 K) was controlled with a thermocouple mounted directly next to the substrate.

The deposition was performed on 2 inches silicon substrates (КЭФ 4, 5) with (111) crystallographic orientation of the growth surface.

Just before loading in the reactor, the substrates were subjected to the following treatment procedures: 1. boiling for 25 min in CCl_4; 2. washing in deionized water; 3. boiling for 25 min in $1NH_4OH$: $2H_2O_2$:$5H_2O$; 4. washing in deionized water; 5. boiling for 25 min in 1HCl: $2H_2O_2$:$5H_2$ O; 6. washing in deionized water; 7. etching for 2-3 min in 1HF: $5H_2O$; 8. washing in deionized water; 9. propanol vapor drying for ~ 2-3 min.

The layers surfaces were investigated by SEM and AFM methods at room temperature under atmospheric conditions. AFM investigations were performed at an installation of NT-MDT Company using the silicon nitride indents.

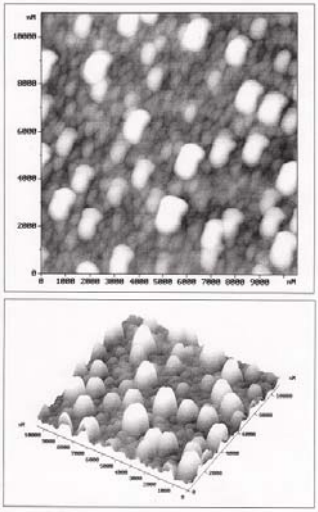

Fig.1. Surface image of AlN buffer layer grown on Si (111) at 1373 K (5 min) by HVPE method, as observed by AFM.

The presence and composition of layers were confirmed by RBS (Rutherford Back Scattering) method using a beam of alpha particles.

3. Results and discussion

In Figure 1 there are presented the AFM images of an AlN layer deposited on Si (111) by HVPE method in two projections. The layer surface is embossed, and the layer appears as a set of dispersed particles (dp), arranged disorderly.

By geometrical dimensions (height, diameter), there are two main categories of particles: lighter particles with larger sizes, and darker smaller particles. The surface density of larger particles is much lower the density of small particles. The surfaces occupied by big and small dp on the substrate are not essentially different, the big/small ratio being 2/3.

Figure 2 shows the AFM topography of two cross sections containing large size dp (top) and small size dp. The height of large size dp lies in the range 100-320 nm and that of the small ones, 80-110 nm. The dp distribution in two categories implies their geometric similarity and makes it easy to distinguish them in the curve of successively increasing peak heights depending on their number (fig.3).

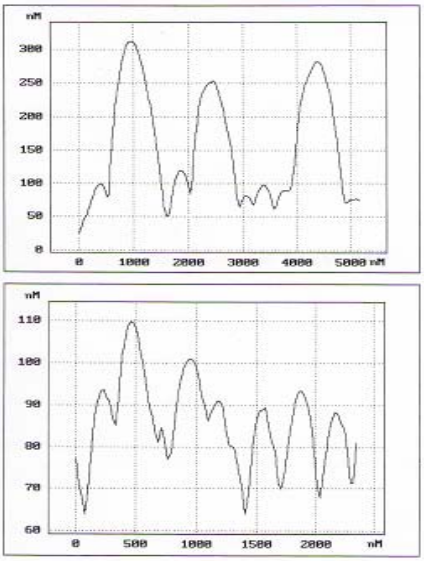

Fig.2. AFM reliefs of a AlN layer deposited on Si (111) for cross sections containing higher dp (top) and lower dp (bottom).

Numbering of particles by size is motivated by the chaotic character of their arrangement on the substrate surface. It is also assumed that their geometric shape remains unchanged during the growth. This assumption is also partially confirmed by the forms of granules of different sizes that have different evolution time. As shown previously [4], the form of 111-N compounds granules changes only with change of the growth temperature or the concentration of precursor reactants. This paper presents the research results for layers obtained under stationary conditions of temperature and concentration of reactants. The figure shows a sharp threshold (130 nm) that separates the small size dp from those of large size. This threshold shows the change of layer growth mechanisms in the process of evolution from the initial stage of nucleation of granules to the subsequent stage of formation of larger dp - the stage of continuous layer deposition.

The continuous layer thickness, estimated from Fig. 2, is ~ 70 nm. The height of large dp reaches ~ 300 nm after 300 sec of deposition (the dp growth rate reaches ~ 1 nm/sec). Taking into account the dp distribution by size (Fig. 3), one can say that the continuous layer is formed after ~ 200 sec of deposition, when there are changes as well in the mechanisms of layer growth.

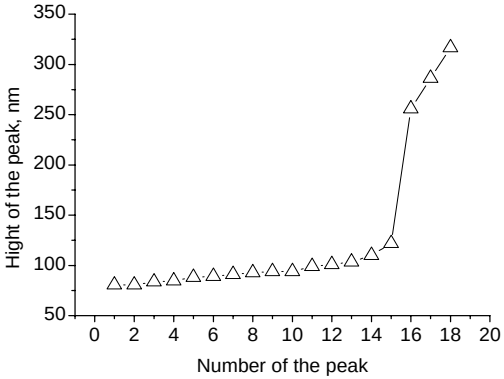

Fig. 3. Distribution by height of AlN dispersed particles deposited on Si by HVPE method at 1373 K, 300 sec.

Figure 4 shows the time dependence of the concentration of AlN dp deposited on the silicon surface. At the beginning of the process their concentration changes insignificantly. Dispersed particles grow only by size. The latency period of concentration evolution changes abruptly after a period of time of ~ 200 sec when a sudden increase takes place. After a very short time the dp concentration decreases sharply to the initial level.

Reducing the total concentration of the granules may be due to coalescence processes of dispersed particles of different sizes.

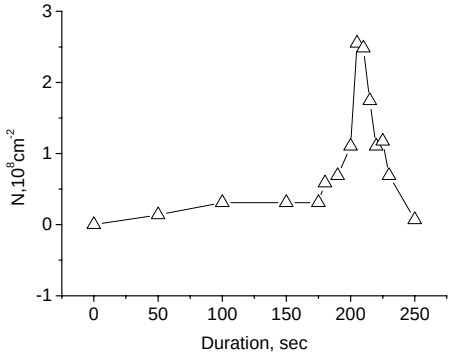

Fig. 4. Change of concentration of AlN dispersed particles, deposited on silicon substrates at the initial stage of continuous layer formation.

Given the above, one can propose a model of AlN layer formation on Si (111). It is known that even the ideal surfaces of perfect crystal substrates obtained have terraces, steps, and contain surface defects with adatoms or dot vacancies, dislocations, linear and other defects. Roughness exceeds 10 nm even on the most perfect Si surfaces. Uneven real surface of substrates significantly affect the nucleation, and growth of the new layer, especially for heterogeneous layers. At the initial deposition stage the germination of layers occurs in the vicinity of defects. Defects are statistically distributed on the substrate surface like the condensed granules of the new phase. The further granule size development is ensured not only by the flow of reactants from the gaseous environment, but also by the flow of compounds formed on the substrate due to surface diffusion processes. Similar mechanisms of mass transfer are also present at heteroepitaxy of GaN layers [2.4]. The surface flow towards the initially formed centers is due to higher affinity between their substances as compared with the affinity between heterogeneous substances (AlN, Si). The growth rate of initially formed granules increases owing to increasing supersaturation over the granules surface as compared with the supersaturation over the substrate surface. At the initial stage of nucleation this difference is insignificant due to relatively low concentration of germination centers and small size of the granules. When the volume (surface) of granules increases, this difference becomes larger, and the flow of reactants to the surface of granules increases. The process of nucleation of new granules on the surface of substrate takes place continuously, but these smaller granules are absorbed by the larger size granules due to the coalescence processes.

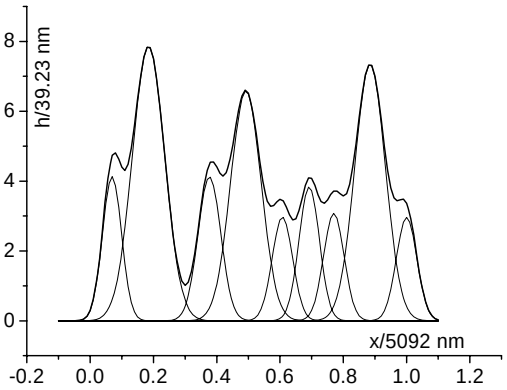

Fig. 5. The approximated relief of the cross-section of AlN layer deposited on silicon. The modulating curve is determined by the relief of elementary dp, described in Gaussian approximation.

Thus, the surface density of granules changes insignificantly during ~ 200 sec. After the substrate is coated with AlN, the surface diffusion mechanism is not more involved in granules development. At the intersection of surfaces of the originally formed larger granules appear sharp boundaries, favorable to nucleation of new granules. Thus, there appear two kinds of granules on the substrate surfaces – big ones evolving from the surface defects of the substrate, and small granules, formed later in the process of AlN layer thickness evolution.

The curve of cross section layer relief can be approximated by a polynomial, whose arguments are elementary Gauss functions, describing the normal distribution of errors (fig. 5). Each argument of the polynomial describes the relief of an elementary granule from all the dp deposited on the substrate surface, with center m_i (x, y). Around this center that is a center of nucleation, the granule size is evolving in time. Mean square deviation σ_i (x, y) is the average granule radius r_i (x, y), and the maximum value of the elementary function f_i (σ_i) = $1/\sigma_i \sqrt{2\pi}$ is the granule height. One can see from this expression that granule height and radius are not independent. Therefore, in order to describe the evolution of granule size in time is sufficient to determine the value of only one of these parameters. This conclusion is of essential value in modeling and investigating the processes of evolving layers deposition [1]. Indeed, the sizes of granules in the substrate plan increase in the process of deposition and granules come in contact, overlap, and the deposited layer covers completely the substrate surface. The granule radius can not be more estimated experimentally.

However the determination of its cross section height does not present difficulties.

The radial symmetry of dp is seen in Fig. 3, where the relief images of two different cross sections are presented. To a great degree it is determined by technological conditions of obtaining, more specifically, of rotation of the substrate relative to the reactant gas flow, as well as by the excessive speed of AlN synthesis reactions. Certain anisotropy of the layer relief is determined by the anisotropy of the substrate and of the compound synthesized.

The formation of separate AlN granules on silicon surface shows that the layer deposit at the initial stage occurs according to the three-dimensional model, 3D (Folmer - Weber model).

4. Conclusions

Using the HVPE method, thin AlN layers were synthesized on silicon substrates. The layer structure was investigated by AFM method. It was found that layers germination takes place according to the three-dimensional model, 3D. The formed granules are an association of dispersed particles, statistically distributed on the substrate surface. In the process of evolution from the initial discrete stage to the stage of continuous layer formation, a change of mechanisms of layers growth takes place. The relief of layers can be approximated by a polynomial, whose arguments are elementary Gaussian functions.

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OXYGEN MASS TRANSFER THROUGH THE AIR - WATER SURFACE RELATED TO THE WASTEWATER TREATMENT

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Abstract - In the present study a model for the oxygen concentration profiles in a mobile bed biofilm reactor (MBBR) is proposed. The simulations have been realized using FlexPDE5 program and the general equation of dispersion (simplified form) has been utilized. Experimental determinations (measurements of the DO concentration) have also been realized. The oxygen profile concentration, in a MBBR reactor, was determined.

Keywords - aeration system; oxygen; moving bed biofilm reactor; wastewater treatment.

1. Introduction

Moving bed systems comprise all biofilm processes with continuously moving media, maintained by high air or water velocity or mechanical stirring. Biofilm carrier material (media or biomedia) is selected based on size, porosity, density and resistance to erosion. By using a material with a large specific surface area (m^2/m^3) high biological activity can be maintained using a relatively small reactor volume. Small parts made of special materials with density close to the water density, are immersed in the bioreactors. The biofilm carriers are kept in suspension and even mixed with the help of air bubbles generated by the aeration system. This type of support is most effective because it is not clogged and unlike rotary contactors do not require additional energy consumption. Worldwide there are several models of biofilm carriers. The MBBR process is based on the aerobic biofilm principle and utilizes the advantages of activated sludge and other biofilm systems without being restrained by their disadvantages.

Water oxygenation is a mass transfer process of oxygen from gas/air to the liquid mass. It can be used in wastewater treatment in order to remove the organic matter. The oxygen in the air, the ozonized air or directly the pure oxygen can be used in the process. In this case, air is introduced in a bioreactor with the help of a blower. The main purpose of this study is to determine the concentration of dissolved oxygen using mathematical

modeling and numerical simulations. In the second stage, several experiments are realized and the aeration system efficiency is determined.

2. Materials and methods

DETERMINATION OF DISSOLVED OXYGEN USING NUMERICAL SIMULATIONS

In recent years, mathematical modeling of wastewater treatment processes has become an accepted tool in engineering practice and is extensively used by consulting companies and regulating agencies. The application of mathematical models ranges from research to treatment plant design, operation, control, and troubleshooting. Computer simulations can be used as a surrogate for performing the actual experiment. For these applications, the model is assumed to represent reality.

In order to build the mathematical model for the determination of the dissolved oxygen profile inside a MBBR reactor, the general equation of dispersion was considered [1]-[4]:

$$\frac{\partial \overline{C}}{\partial t}+\frac{\partial}{\partial x}\left(\overline{u}\overline{C}\right)+\frac{\partial}{\partial y}\left(\overline{v}\overline{C}\right)+\frac{\partial}{\partial z}\left(\overline{w}\overline{C}\right)=\frac{\partial}{\partial x}\left(\varepsilon_x\frac{\partial \overline{C}}{\partial x}\right)+\frac{\partial}{\partial y}\left(\varepsilon_y\frac{\partial \overline{C}}{\partial y}\right)+\frac{\partial}{\partial z}\left(\varepsilon_z\frac{\partial \overline{C}}{\partial z}\right)+$$
$$+D_m\left(\frac{\partial^2 \overline{C}}{\partial x^2}+\frac{\partial^2 \overline{C}}{\partial y^2}+\frac{\partial^2 \overline{C}}{\partial z^2}\right)+S(x,y,z,t), \qquad (1)$$

where ε_x, ε_y, ε_z are the longitudinal, transversal and vertical dispersion coefficients. A complete solution of this equation, where the equations of motion and continuity must be attached, is impossible to obtain because of the dispersion coefficients dependence on the flow regime, the nature, form and size of dispersed particles. For this reason, a simplified model was applied. To simplify the equation the orthogonal Cartesian system Oxy is considered and the dispersion equation becomes [2], [3]:

$$\frac{\partial \overline{C}}{\partial t}+\frac{\partial}{\partial x}\left(\overline{u}\overline{C}\right)+\frac{\partial}{\partial y}\left(\overline{v}\overline{C}\right)=\frac{\partial}{\partial x}\left(\varepsilon_x\frac{\partial \overline{C}}{\partial x}\right)+\frac{\partial}{\partial y}\left(\varepsilon_y\frac{\partial \overline{C}}{\partial y}\right) \qquad (2)$$

where quantities are averaged over a period of time.

OXYGEN TRANSFER FUNCTION, NON-STEADY STATE METHOD

Oxygen transfer, the process by which oxygen is transferred from the gaseous to the liquid phase, is a vital part of a number of wastewater treatment processes. The functioning of aerobic processes depends on the availability of sufficient quantities of oxygen. Because of the low solubility of oxygen and the consequent low rate of oxygen transfer, sufficient oxygen to meet the requirements of aerobic waste treatment does not enter water through normal surface air-water interface. To transfer the large quantities of oxygen that are needed, additional interfaces must be formed. Oxygen can be supplied by means of air or pure oxygen bubbles introduced to the water to create additional gas-water interfaces. In wastewater treatment plants, submerged bubbles aeration is most frequently accomplished by dispersing air bubbles in the liquid. The most commonly used diffuser system consists of a matrix of perforated tubes (or membranes) or porous plates arranged near the bottom of the tank to provide maximum gas to water contact. Oxygen transfer takes place from the rising bubbles to the mixed liquor to supply the oxygen requirements for the biological process.

For good performance the rate of supply of dissolved oxygen should be equal to the rate of oxygen consumption exerted by the mixed liquor under any given set of circumstances.

A number of equipments and operational parameters interact to influence the efficiency and rate of transfer of oxygen such as: tank dimensions (length, depth and width), aeration size, type, location, and airflow rate. Conditions in the mixed liquor also have an impact on the transfer; for example, temperature, ionic strength, presence of surface-active compounds, and solids concentration. The rate of oxygen transfer (under the conditions prevailing in an aeration basin) is governed by the liquid phase mass transfer coefficient, K_L. Determination of K_L poses experimental problems in that knowledge of the interfacial area for mass transfer, A_t, per unit volume, V, is required. For this reason the rate of transfer for a particular system is usually reflected by the overall mass transfer coefficient, K_La:

$$K_L a = K_L \frac{A_t}{V} \qquad (3)$$

where:

K_La - apparent volumetric oxygen mass transfer coefficient in clean water, h^{-1};

V - water volume in the tank, m^3;

A - interfacial area of mass transfer, m^2;

a - the interfacial area per unit volume, m^2/m^3.

There are several methods of experimental determination of mass transfer coefficients. The so-called clean water non-steady state method was selected in this study. The unsteady state test or re-aeration of deoxygenated clean water (reoxygenation) is presently the most broadly accepted test procedure [6]. The accepted procedure for determining and evaluation the overall oxygen transfer coefficient (K_La) is considered as follows. The test method involves the removal of dissolved oxygen (DO) from a known volume of water by the addition of sodium sulfite followed by reoxygenation to near the saturation level. The DO of the water volume is monitored during the re-aeration period by measuring DO concentration at several different points. The basic equation describing the rate at which oxygen is absorbed by water is [6]:

$$\frac{dc}{dt} = K_L a(C_{st} - C_t) \tag{5}$$

where:

d_c/d_t - transfer rate of oxygen to the water, mg/l;

C - concentration of oxygen in the water at time, t, mg/l;

C_{st} - saturation, or equilibrium, mg/l;

t - time.

The difference (C_s, - C) between saturation value and actual concentration of oxygen (C) in the body of the liquid phase is usually called oxygen deficit. The oxygen transfer rate is determined by integrating of this equation. From (5), the initial oxygen uptake rate at $C_t = 0$, is:

$$\frac{dc}{dt} = OC = K_L a(C_{st}) \tag{6}$$

where OC is the oxygen transfer capacity of the system, (kg O_2/h).

The fraction of oxygen transferred to the water due to the pass of one-meter cubic of air is expressed as oxygenation efficiency, E, of the diffuser system, which can be written as:

$$E = \frac{OC \cdot H}{I} \tag{7}$$

where I is the aeration intensity, or volumetric air flux per unit area of tank surface.

3. Results and discussion

Results from the numerical simulations. The results obtained from numerical simulations are presented in Fig. 1 - 4. Several cases were considered: longitudinal section through the bioreactor without and with biofilm carriers in different proportions and cross section without and with biofilm carriers in different proportions. Analyzing Fig. 2 it can easily be observed that biofilm carriers help the oxygenation process. Resulting air bubbles rise to the surface and in their way up they meet the biofilm carriers. Due to their interactions with the bio-media, bubbles divide and by-pass the biofilm carriers. The time contact between air and wastewater increases and that is why a better oxygen mass transfer is obtained. The increasing quantity of the biofilm carrier inside a MBBR reactor leads to a better mass transfer. The same conclusion results from the figures which represent the cross section (Fig. 3 and Fig. 4). For this section a larger number of numerical simulations have been made. For the longitudinal section the amount of biofilm carrier inside the bioreactor cannot be increased very much because the program is very complex and the geometry domain is very large and blocks the software roll-out.

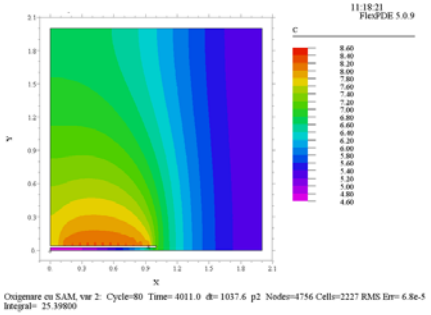

Fig. 1 - Dissolved oxygen concentration profiles - longitudinal section

Only in Fig. 4 a larger amount of biofilm carrier can be observed. In the case where biofilm carriers was not considered to be introduced inside the

bioreactor (Fig. 4), the minimum value for DO concentration was 6.2 mg/l, and in the case represented in Fig. 4 (where is considered a maximum quantity of biofilm carriers is considered) the minimum value for DO is 7.3 mg/l. It is clear that biofilm carriers inside a bioreactor improve the oxygen mass transfer.

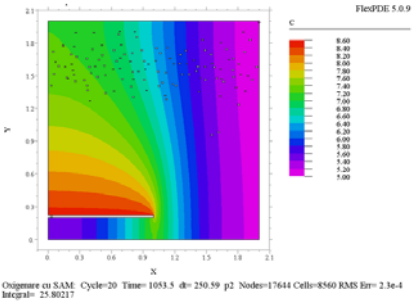

Fig. 2 - Dissolved oxygen concentration profiles - longitudinal section

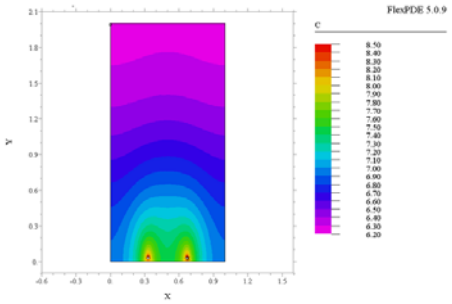

Fig. 3 - Dissolved oxygen concentration profiles - cross section

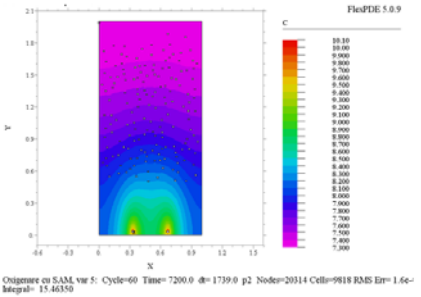

Fig. 4 - Dissolved oxygen concentration profiles - cross section

Results from the experimental work. Measurements were made in a bioreactor with 2 m length and height and 1 m width. An aeration system with medium bubbles is considered (air is introduced with a help of perforated pipes).

The transitory regime was used for determinations – the variation of DO concentration. The method is to measure the modification of DO concentration in time, from 0 mg/l to the saturation concentration. Zero oxygen concentration was achieved by adding excess of sodium sulphite in the presence of cobalt ions, as described in previous section. In this way, the initial DO in the water was consumed. Excess sodium sulfide, up to 10-20% is consumed by introducing air into wastewater mass and the moment when DO reach 0 mg/l is considered the measurements' baseline.

A constant air flow, which was introduced by the aeration system Q_{air} = 50 m^3/h, was established. Two measuring points inside the bioreactor were established. The two sensors were placed at different immersion depths as follows: first sensor was located in the center of the basin at a distance of 0.5 m from the slab foundation (bioreactor base) and the second at 0.3 m. Tap water was introduced inside the bioreactor and no biofilm carries was introduced. After this stage, the bioreactor was allowed to operate 2 hours in order to reach a permanent hydraulic regime. Then, the process of decreasing DO concentration to 0 mg/l, by adding sodium sulphite and catalyst, began. From the analysis of graphs obtained it was observed that similar values were registered by the 2 sensors. The experimental curve approaches the curve described in the literature [2], [3], [4], [5]. It is noted that at the measurements beginning, in the first 20 minutes the concentration of dissolved oxygen in the water is rising rapidly, and after this period a small increasing is achieved which tend to saturation. Curve slope between 0.2 and 0.8 of saturation concentration gives us an idea on global mass transfer coefficient.

For the next set of measurements, the air flow was modified. The air flow rate injected by the aeration system was Q_{air} = 100 m^3/h. The measuring points were the same as in the previous case. This set of measurements was performed under the same conditions as the first, the same steps were followed. Second sensor being located closer to the slab

foundation, had registered lower values of dissolved oxygen comparing with the first sensor, which was located above.

Another set of measurements was realized on clean water and biofilm carriers. The filling ratio and the specific surface area of the biofilm carriers are the two main design parameters. The filling ratio ranges from 30–70% of the total reactor volume. It is recommended that the filling fractions should be below 70% so as to be able to move the carriers freely. Some studies [7] recommended that the surface area of the biofilm carriers should be calculated based on the internal (protected) surface because microscopy has shown no sign of biofilm growth on the outside of the smooth plastic elements due to the erosion of biofilm caused by the frequent collision between the particles. In our case the bioreactor was 50% filled with biomedia. In this case only one sensor was used to measure the dissolved oxygen levels, because it was not known whether the interaction between biofilm carriers and the sensor will affect the measuring equipment. Measurements were performed for an air flow of 75 m^3/h.

To conclude on the effectiveness of aeration system the chart shown in Fig. 5 was made. The analysis of the chart shows that the introduction of the biofilm carriers in the bioreactor improve the oxygen mass transfer (same conclusion resulted from numerical simulations).

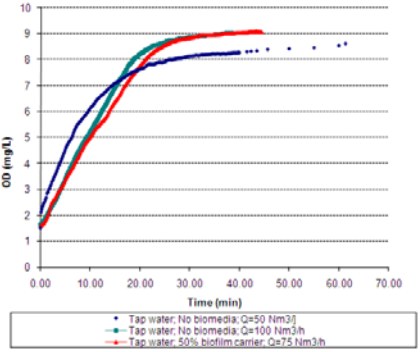

Fig. 5 - DO variation, comparative graphic

The graphic obtained for the case of biofilm carriers and an air flow of 75 m^3/h is similar to the case without biomedia, but with a greater air flow - 100 m^3/h. These results show that the introduction of biomedia in the

bioreactor increases the time contact between air bubbles and water and so the mass transfer of oxygen is more efficient.

4. Conclusions

The advantages of using mobile media are: minimum footprint, fully automatic operation, modular construction, technology with fixed biofilm, guaranteed biofilm carrier to 20 years, adaptability shock load, very little sludge production, low investment, minimal labor force, rapid installation and easy, reduced operating costs, organic load can be increased by 500% for the same volume of the bioreactor and efficient method for upgrading existing wastewater treatment plants from various sources (food, pulp/paper, pharmaceuticals, textiles, beer, refineries). In conclusion, because of the numerous benefits listed above, we recommend the utilization of this technology in wastewater treatment processes. Aeration processes can consume up to 70% from the total electrical energy needed by a WWTP, so that is why new solutions for improving the oxygen mass transfer must be implemented.

Acknowledgments

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COMPOSITE MODULAR STRENGHT LOW PROFILE PARTIAL FOOT PROSTHETIC

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Abstract: Prosthetics foot for amputation are widely used in two forms – insole and socket form prosthetics – made out of different materials like silicone, carbon fiber, fiber glass or plastics. All these devices has two problem, they have a good behave for normal activity like walking and the height or thickness of the prosthetics force the practioner to equilibrate the body using insole on the opposite side. My project propose a new design capable to be modulate according to daily activity like walking, running, climbing, etc.

Keywords: partial foot prosthetics, composite foot prosthetics

1. Introduction

Definition and types of partial foot amputation

PFA could be described as amputation affecting a portion of the fore, mid or hind foot, but does not include amputation disarticulating the ankle joint (Symes), consistent with the International Standards Organisation definitions (International Organisation for Standardisation 1989).

There are numerous levels of PFA that can be described in a variety of ways. Some amputations are termed 'longitudinal' given that they affect the structure of the foot along its length – resection of several metatarsals or 'rays' would be a typical example. Other procedures are described as 'transverse' meaning that they transect a portion of the foot - a transmetatarsal (TMT) amputation (Figure 1a), as its name suggests, transects the metatarsals through their shaft.

About three-quarters of all PFA involve the toe(s) and/or disarticulate the metatarsophalangeal joint (Figure 1a). More proximal amputations, including transmetatarsal (Figure 1b) or mid-tarsal amputation are performed less frequently (Australian Institute of Health and Welfare 2009c; Dillingham et al. 2002a; Owings and Kozak 1998).Tarsometatarsal and transtarsal amputations are commonly described using eponyms such as Lisfranc (Figure 1c) or Chopart (Figure 1d) after the surgeons who coined these procedures, as are Boyd and Pirogoff procedures for the hind-foot.

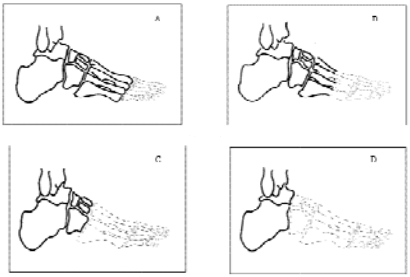
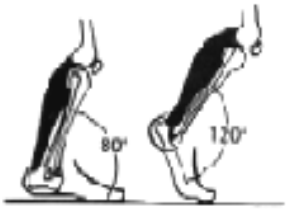


Fig 1. Schematic of various levels of partial foot amputation: (A) disarticulation of the metatarsophalangeal joint, (B) transmetatarsal, (C) tarsometatarsal (Lisfranc) and (D) transtarsal (Chopart) (D).

2. Materials and methods

Two materials are used for the making of the prosthetics – silicone 20 shore and carbon/aramid fiber composites. For the making of the prosthetics the pacient is placed in orthostatism position for the plaster casting. Orthostatism position is essential in order to determine the dorsiflexion of the stump that normally apear in partial foot amputation. The cast is for the stump area plus the tibial region in approximative 5-10degree plantar flexion. Normal prosthetics have an 90degree between the stump area and tibia, that meaning that the first contact during walking will be done on calcaneus area – a great disadvantage for an amputee from a biomechanical point of view.



The disadvantage start once the amputee go for the second stage of walking, stance phase. It is well known that partial foot amputee has the tendency to dorsiflex the foot, that means a lower profile of the support area, less stability and a very greate dependency of the prosthetics elasticity for the next stage, propulsion.

There are three major contact point, minimum three for a good stability, in a partial foot prosthetics – heel, anterior face of the stump and dorsal face of the stump. For the design of my model I considered this three

point and three activities – driving (pushing a pedal), walking stairs , vaulting (from a knee flexed position). Each of this activities are very stressfull for the prosthetic and for the pacient stump.

The purposes of the design are:

- Less stress in the contact area
- To build a structure with enough strenght for this activities
- To build a design capable to be upgrade in case of a high performance activity (climbing on mounting rock where anterior support of the prosthteics is a necessary

My proposal is a design that prepare the stance phace with a bigger area of contact, a phisiological heel contact, a profile that do not increase the height between the foot and the ground and a multilayer system that can be upgrade very easy in case of high stress activities.

Fig.2. The carbon/aramid fabric as raw material for the strut

The parts of the prosthetics design are: the tibial suport, 1/3 anterior heel support and posterior heel support, a multylayer carbon/aramid composite – silicone anterior suport for propulsion phase.

For the prosthteics strut I used Comfil carbon/aramid reinforcement with epoxy resin matrix. The thicknes of the layers range from 1mm to 3mm depending on stress. Between each layer of composite there is a silicon layer of about 1mm to 2mm. The silicone is 20shore hardness. Each layer is incastrated in the tibial anterior support in a very simply way, by a needle clamp. The anterior side of the strut is united through a silicone glove that make the bridge with the calcaneal area.

Fig.3 two partial foot stump

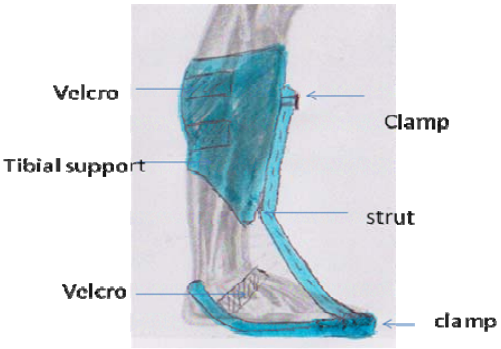


Fig.4. general aspect of the design.
The strut is made of carbon/aramid – silicon layers

3. Results and discussions

The new design was tested on pacient. As they said the design is very light, allow him a great range of mobility, he feel safety and capable to do more activities than before with other model. Because the system is modular the future cost is lower, the only thing that has to be upgrade is the strut in that involves new layers of composite.

4. Conclusion

The new design will be tested on pacients of diferent ages and different activities pattern in order to be implemented on the market in a kit model.

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THE INFLUENCE OF EXTERNAL ELECTROMAGNETIC FIELDS ON THE CARDIOVASCULAR SYSTEM - Review

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Abstract: *In this paper we consider the influence of electromagnetic fields on the cardiovascular system. There has been tried to highlight some changes within the ECG signal (wave form, amplitude, duration etc.), heart rate, blood pressure by people exposed to the electric, magnetic and electromagnetic fields. Exposure time, type and field characteristics (magnetic or electric field, frequency, amplitude, shape) are taken into consideration.*

Keywords*: ECG, HRV, electromagnetic fields. human exposure.*

1. Introduction

Due to environmental electromagnetic fields, intentionally (communications, etc.) or unintentional generated, people are constantly exposed to these, either accidentally (in public) or at the work place (employees exposing). Nevertheless for the medical field are being used therapeutic procedures or diagnostic methods that utilize electromagnetic fields. All these lead to the study of electromagnetic field interaction - biological environment, and in particular to study the influence of external electromagnetic fields on bioelectric signals.

2. Exposure fields levels

1. Background field

The Magnetic field levels in homes reach values between 0.05 to 0.4 μT exposure to ELF electromagnetic fields, especially at 50/60 H and a higher level of magnetic fields is very close to household appliances. People who live near power transmission lines, or workers who live in industrial areas, may always be exposed to magnetic fields above 1 μT. The level of tens of μT can occur for short periods of time in certain work situations.

Table 1. Typical values of low frequency magnetic field associated to sources in homes, workplaces and public places.

Field source	**Frequency** (Hz)	**Density of magnetic flow**
	Offices, homes	
Background	50/60	0.05-0.4 μT
Household appliance	50/60	0.01-0.5 μT la 1 m 0.1-30 μT la 0.3 m
TV	30-3000	0.02-0.6 μT la 0.3 m
	Research centers (staff areas)	
Linear Accelerator	0	0.1-5 mT
Power panel	0	>50 mT
Power generator	0	1-60 mT
	Industry	
Power Processes	0, 50/60	1-10 mT
Aluminum Production	0	1-10 mT/ 60 mT
Electrical and induction furnaces	1-10000	1-50 mT
Welding machines	0, 50/60	0.2-10 mT
Security systems	0.1-10000	Until la 1 mT
The average exposure of workers	50/60	1 μT electric 0.17 μT nonelectric
	Power Systems	
380kV transmission lines	50/60	1-20 μT
15kV distribution lines	50/60	0.05-0.4 μT
20 MWh S/C Energy Storage	0	0.5 T (maximum attainable field) 10 mT at 300 m
	Transport	
Magnetic levitation train (Maglev)	0	2-6 mT (head level) 20-50 mT (floor level)
Subway	50/60	0.7-1 mT
	Medicine	
RMN	0	0.5-2 mT (operator) 2 T (patient)
Therapeutic devices	12-75	1-10 mT

2. Specific workplace

Table 2. Limits of static magnetic field at the exposed persons

	Static Magnetic Field			
	SLAC	CERN	CENTELEC TC 111	ACGIH
Work day / entire body	20 mT	200 mT	200 mT	60 mT
Work day / limbs	200 mT			600 mT
Short exposure/ entire body	200 mT	2 T	2 T	
Short exposure/ limbs	2 T	5 T	5 T	2 T
Public exposure / entire body		10 mT	40 mT	
Public exposure / limbs			100 mT	
Persons with pacemaker		0.5 mT	0.5 mT	0.5 mT
Earth's magnetic field			50 μT	

3. Therapy and diagnosis

[Simunic *et al.* 1995] used a model to simulate human bust exposure to alternative magnetic fields that can occur during magnetic resonance imaging (MRI). They have calculated the induced current density threshold required for depolarization of a heart cell. The results showed that stimulation of the heart cells will not occur during standard exposure used in medicine and industry (1.5 T, with a gradient rise time of 0.3 ms, 10 mT / min). For stimulation of magnetic pulse field strength threshold for cardiac effects are much larger than the thresholds for neuromuscular effects [Reilly 1991]. Therefore violence in skeletal muscle contractions may occur before any cardiac abnormality. The phenomenon has been demonstrated in animal studies by [McRobbie and Foster 1985].

Table 3. Limit values for public exposure to static magnetic field and low frequency magnetic field

	Low frequency magnetic field				
	CENELEC TC 111	ACGIH	ICNIRP (50/60 Hz)	Poewr line (50/60 Hz)	
Day / entire body	80/f 1.6 mT(50 Hz)	60/f 1.2 mT (50 Hz)	0.5 mT 5 mT	Italia	100 µT 1 mT
day /limbs	1250/f 25 mT(50 Hz)	300/f 6 mT (50 Hz)	25 mT	Florida	15 µT
Public exposure / entire body	32/f 0,64 mT (50 Hz)		0.1 mT 1 m T	New York	20 µT
Public exposure / limbs	500/f 10 mT (50 Hz)				
Persons with pacemaker		0.1 mT			

3. Electromagnetic field effects on the cardiovascular system

Creasey and Goldberg [1993] note that reports of the former Soviet Union in the early 60s showed arrhythmias and tachycardia by workers working with high voltage equipment (such as fields of 26 kV / m).

However, the following studies in Western countries, did not confirm these effects [Knave and Floderus 1988]. There was no confirmed exposure to EMF used as therapy for hypertension [Orlov 1991].

[Knave *et al.* 1979] and [Stopps and Janischewsky 1979] have not reported any significant effect on cardiovascular function of workers exposed to ELF and EMF.

There were conducted tests in which people were exposed to electric fields of 20 kV and 0.3 mT magnetic fields through the body while transmitting a voltage of 500 μA at 50 Hz. There was no significant effect on heart rate or blood pressure. [Checcucci 1985] did not record any effect of exposure to EMF and ELF (1-4.6 kV / m, 4-15 μT) on the cardiovascular system of over 1200 workers in high voltage substations. [Savitz and Loomis 1995] found that mortality caused by heart disease is lower than what was anticipated for the general population (standard mortality rate of 0.76). [Gurvich 1995] did not report any excess of cardiovascular disease on station operators or on ordinary workers exposed to ELF or EMF (voltage of 2000 kV / m).

[Easterly 1982] developed a model of the cardiovascular system to estimate the potential increase in blood pressure during exposure to magnetic fields. He concluded that "an individual cardiovascular disease resulting from exposure to static magnetic fields should not constitute a serious problem".

The "Midwest Research Institute", USA studied the effects on HRV low-frequency field for many years [Jauch 1996, Graham 1994]. Their results show that exposure to electric and magnetic fields of 60 Hz are leading to a significant decrease in heart rate. HRV decrease related to the magnetic field was statistically significant in those subjects exposed to field first and then to the simulated conditions. They did not record a significant decrease in heart rate.

1. Effects of induced current density in the human body

The only rule universally accepted is that produced by IRPA and says that absolute limit allowed without any risk is 10 mA / m for the induced current density.

In the table below is being systematized the density of induced current effects in the human body.

Table 4. Effects of induced current density in the human body

Current density m^2/m^2	**Effect**
< 0,1	ineffectiveness
1-10	biologic effect
10-100	Noticeable effects: visual, possible effects on the nervous system, favoring fractures
100-1000	Changes in excitability of the central nervous system, possible health risks.
> 1000	Extrasystoles, ventricular fibrillation potential.

For a high current density of 10 mA / m appear stimulating effects on the nerve and heart cell. They are applied with a safety factor of 10 for exposures that may affect particularly fragile people (pregnant women, elderly, etc.).

Table 5. Limit values of public exposure for 50Hz electric and magnetic field

	Induced current	Field values
Electric field	2 mA/m^2	5 kV/m
Magnetic field	2mA/m^2	100μT

2. Static Magnetic Field

[Jehenson 1988] demonstrated an effect of static field on HRV. The field exposure showed a 17% increase in cardiac cycle length; the values returned to normal after 10 minutes of exposure. Effects on sinus node are probably harmless on healthy patients, but the main issue is a security exposure of patients with chaotic rhythm.

3. ECG changes within human body exposed to 50 Hz magnetic fields

Some studies conducted by [Graham *et al.*1994] have shown that the amplitude of the electric and magnetic fields affect the human cardiovascular system. Laboratory studies have shown that unlike sham exposure, field exposure had a significant effect on the cardiovascular system. There was a subtle response in four studies that have been used in fields of 9 kV / m and 200 mG (20 μT). No reply came in two studies with exposure to fields with a strong intensity, 12 kV / m and 300 mG (30 μT), and no exposure to the weakest fields of 6 kV / m and 100 mG (10 μT).

The cardiac response does not appear to be cumulative and effect is not a function of exposure duration and field strength. The results show that it is possible to have "windows" of the amplitude through which it can be seen the effects on heart [Graham *et al.* 1990], [Graham *et al.* 1994]. The most important result was the increased latency from R wave to T wave within ECG, which was found only on the group "environment" in order on subjects exposed to field-simulation order.

This decrease in heart rate mentioned above was rarely identified in other studies, e.g. laboratory of [Whittington 1996] found no effect of the magnetic field of 50 Hz, 100 μT (of different durations) on HRV or blood pressure. It was also reported decreased heart rate after exposure of 50 Hz EMF (up to 10.21 kV / m and 15.43 μT for several hours) [Korpinen 1993].

In another study [Srdjan 2005], there were territorially inspected a number of substations in order to determine suitable locations for making measurements, there were three sites selected for review (sites 1, 2 and 3). In each of the three locations, was created a local map of the magnetic field distribution with "low" "medium" and "high" exposure.

The value Time Weighted Averages (TWA) of the magnetic field at 50 Hz was a measure of exposure. In each of the three locations examined, the TWA value was calculated as the sum of the local magnetic field strength parameter B_i and the parameter weight w_i, over all N points where measurements were made as in the following formula: $TWA = \sum_{i=0}^{N} w_i \left| \overline{B_i} \right|$.

Where w_i represent the estimation of exposure period observing changes at different points $w_i = \frac{t_i}{12h} . \frac{n_{wi}}{N_w}$. Where t_i is the average length of charge, 12 h is the duration of an exchange, n_{wi} is the number of regular workers and N_w is the total number of monitored workers.

The Multivariate Analysis of Covariance (MANCOVA) was guided in order to determine the effect of exposure to ELF EMF ("low", "medium" and "high") on the five parameters using individual exposure time.

Providing adjustments and respecting the exposure duration only the ANCOVA was significant on the QTc intervals.

Although the observed changes in PR intervals showed a similarity with QTc values, statistical analysis showed no significant difference over the added PR value. No other significant effects were observed in the examined ECG parameters.

In most studies was observed an increase in signal amplitude of the T wave in ECG during exposure to magnetic fields. This change is the result of a duplication of the electric potential generated by aortic blood flow in the presence of magnetic fields. T wave was more affected than other parts of the ECG. Increased voltage of T wave was not related to the electrical activity of pacemaker and ECG rate was a mere reflection of the coincidental "magnetohydrodynamic" voltage, generated by blood flow in presence of applied magnetic field.

4. Influence of 50 Hz magnetic and electric fields on human blood pressure

The effect of electric and magnetic fields on blood pressure has been also studied before. When monkeys were exposed to static fields of 1.5 T,

there could not have been revealed specific changes in blood pressure [Tenforde 1986].

In another study, dogs were exposed to field strengths above 10 kV / m and there have been detected temporary increase in blood pressure [Cerreteli 1976].

[Graham *et al.* 1990] found that intermittent periods of exposure to the field can induce both increased and decreased human heart rate when field strengths are 9 kV / m and 200 mG. Additional tests showed that prior to exposure heart rate is a significant indicator of individual cardiac reactivity.

During the ECG analysis [Korpinen 1994] found a decrease in heart rate after exposure in some cases, but it is possible that changes in heart rate have been caused by small changes in physical charge. Therefore the study was intended to highlight possible changes in heart rate when people were exposed to electric and magnetic fields of 50 Hz. It was also intended to study other possible changes to the entire cardiovascular system to clarify the possible causes of change in heart rate.

5. The effects of RF fields

The recent developments in electromagnetic technology have resulted in exposure sources capable of generating pulses at relatively short intervals between them. Because of the short pulse and low frequency (relative to conventional microwave transmitters), the average density of energy during any period of exposure (and the resulting absorbed energy) is very low. Energy absorption in people exposed to these systems will be considerably less than "levels presented as safety principles". The exposure to electromagnetic fields, especially in the microwave range, is the use of mobile phones in the vicinity of the user's body during a call (near head) or awaiting a call (worn at the waist, in a pocket, etc.).

The Local Exposure Limits (for body parts) are also deducted based on thermal criteria. According to FCC, specific absorption rate energy limit (SAR) for localized exposure is $\leq$ 8 W / kg in occupational exposure and $\leq$ 1.6 W / kg for population exposure.

[Jauch and Frei 1995] have investigated the cardiovascular changes at non anesthetized rats exposed to microwave energy at high frequencies of 1.7-1.8 GHz (peak density 3.3-6.5 kW/cm^2 kW/cm^2) and 1.2-1.4 GHz (14.6-51.6 kW/ cm^2 peak density). After attenuation of the microwave source sound, there has been no significant changes in blood pressure or heart rate during or after exposure.

Some electromagnetic sources may produce electromagnetic repeated pulses on nanosecond with time of occurrence and in the nanosecond and a corresponding frequency bandwidth. There was stipulated biological damages tissue, resulting from the propagation of these pulses.

[Erwin and Hurt 1993] have summarized studies of cardiovascular responses in anesthetized rats to ultra-wide band pulses. Animals were exposed to pulses for 2 min [60 Hz, the peak intensity of the electric field 250 kV / m, rise time 310 ps]. There was no difference in heart rate or blood pressure after exposure to the "ultra wide band. [Jauch *et al.* 1995] studied the cardiovascular effects of exposure to ultra wide band pulse (318-337 ps rise time, the electric field exceeding 21 kV / m, frequency of occurrence 1 - or 2 - kHz) over several periods. There have been no significant changes in blood pressure or heart rate in anesthetized rats during and after exposure.

4. Discussions and Conclusions

The biological responses depend on field strength, specific exposures, in which is explored the relationship between field intensity and response - which may be different for different points. The exposure levels are comparable in magnitude in the same way as the field strength is associated with high voltage substations. They found a significantly decreased heart rate and an increase in latency from R wave to T wave.

One conclusion is that the relationship between field intensity and response can be nonlinear and that the relationship between the dose-response differs for different points. These results may indicate that more than one mechanism can be involved in producing the intensity of a "window".

The research has shown that statistics are very low levels, from 0.08 for small effect, up to 0.46 for large effects. In practice this means that small effects of the EMF will remain undetectable due to low test sensitivity. Most of all the published studies, if not all, had a little chance to detect effects associated with EMF weakness.

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BEZIER CURVES ISSUES REGARDING PROGRAMMING COMPUTER PROGRAMABLE GRAPHICS

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Abstract Bezier curves are frequently used in programable graphics, common as shape drawing tools, but there are cases when this curves are used for numerical approximation. Inside drawing tools toolbars, Bezier curves might be simple, or, more common, under sPline interpolation. This paper reviews the theoretical concepts that made possibile the appereance of Bezier curves, different variants for modelling parameters, and issues regarding Bezier implementation inside software graphical libraries, for aproximation-digitizing and drawing-modelling. The synthesis exposed in this article reveals solutions for real situations, being made after our experience of implementing Bezier curves inside working computer applications for technical design.

key words Bezier curves, technical design, CAD, assisted

1. Introduction

1.1. Requirements of graphical modeling and Bezier curves

Graphical modeling, assisted by computers, is a component of drawing programs, which are current classified in two categories:

• ***raster graphics*** - are programs that provide solutions for graphical editing images, creating specific networks formats *(msPaint, Photoshop, Gimp, Corel, etc ...)* these programs focus on *image quality;*

• ***analytical graphics*** - are programs for computer-aided technical design, which put less emphasis on quality, but for *accuracy (AutoCAD, ProEngineer, etc ...).*

In time, programs were able to manage both graphic types, which led to the category of ***hybrid graphics.***

Sought to introduce the possibility of drawing the curves in these programs, aiming getting some connected outline contours *(specific to raster graphics)* or obtain connected-editable outlines *(specific to analytical graphics).* Later, after the implementation of simple curves, problems arose in their rotation relative to a reference cartesian system, such as reference

curves were faithful to the original system. By rotation, curves loses precision, and so there were required corrections after rotation procedure, necessary for drawing them in inclintate reference systems.

Thus arose the need of developing self-return curves (**figure 1**).

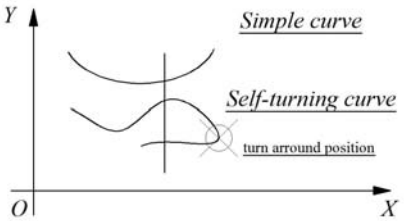

Fig. 1. Ilustration of a simple curve and of a self-turning curve

Unlike simple curves, curves with self-return present particularity that a vertical axis can intersect them in at least one point that, and the evolution of their projection on OX axis shows no one single sense, but oscillations.

The oscillations occur around self-turning positions (**figure 2**), positions that at limit can provide two solutions, depending on the direction of scrolling on the curve; the same feature is available for cartesian ellipses in points corresponding for $\theta=[0^o, 180^o]$.

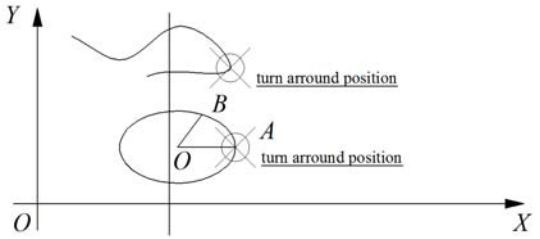

Fig. 2. Self turning positions for a Bezier curve and an ellipse

Thus, for an ellipse, if we consider two limits around position A, we have:

$$f(\theta-\varepsilon) = A_1, f(\theta+\varepsilon) = A_2, \text{ where } \varepsilon \to 0 \qquad (1)$$

For position A, $\theta=0[^o]$. Points A_1 and A_2 are symmetrical to the OX axis. Thus, defining the ellipse using a formula able to provide two values for the same x, is impossible, and therefore defining ellipse with cartesian

equations it is a set of two equations, one for the top half (above the axis OX), and one for the bottom half: $y = \pm b\sqrt{1-(x/a)^2}$.

The radical presence makes mathematical analysis more difficult, such as *differentiation* and *integration,* and therefore are prefered the ellipse parametric equations, equations which are not dependent on the abscissa ***x,*** but on an ellipse associated parameter ***θ.*** Thus, is easier and more elegant to define a position on the circumference of the ellipse, B(x,y)=B(a*cos*[θ], b*sin*[θ]). If ellipses are rotated, (ellipses semiaxis aren't paralell to reference system axis), there are *specific cuadric equations.*

The parameter ***θ*** helps computing ellipse trajectory, and for a full ellipse, ***θ=[0°.. 360°]***, but not always aparticular ***θ*** angle coincides with the real value of the specific position, ie, to point B, ***θ ≠∠ (AOB)***. In general, this equality takes place in the gabarit positions of the ellipse, like for ***θ∈ [0 , 90 , 180 , 270] ,*** where ***θ=k(π/2), k∈ Z*** **(2)**.

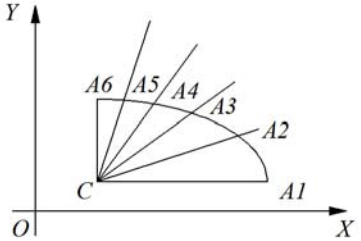

Fig. 3. Incremental positions on an ellipse circumference

Therefore, the inequality between parameter ***θ*** and the real angle (*geometrical one*) results in an accelerated trajectory generation . For example, in **figure 3**, the angles (A_1CA_2) , (A_2CA_3) , ... , (A_5CA_6), are all equal to the value 90/5 degrees; however, distances [A_1A_2] , [A_2A_3] , ... , [A_5A_6] are not equal. This equality is valid only for the circle, considered *particular case* of the ellipse with equal semiaxis.

Thus, returning to self-returning curves, their definition requires a ***parametric definition***, using a specific trajectory value, and not specific to the reference axis system. Thus, modeling is fair to the shape (*curve*), and less to the reference system. Principle illustrated in the case of the ellipse, defining parametric triggers an accelerated trajectory generation, is also available for Bezeir curves.

Terminology ***accelerated trajectory generation*** of a geometric element circumference is associated with stressful path / undertension path.

Finding corresponding algorithms to implement these concepts in the programming is ***digital`s geometry*** duty.

1.2. Several definition for Bezier curves

There are many definitions of Bezier curves, as a result of different graphical areas in which it was necessary to define them. Whatever the final modeling equations, defining Bezier curves are based on the following **(figure 4):**

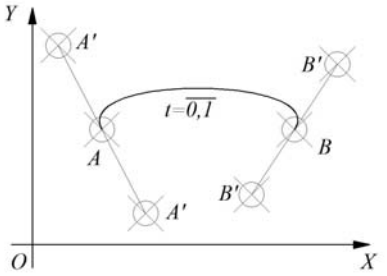

Fig. 4. Bezier curve

- *head-end positions* - ***A, B*** are physical points, between which the Bezier curve may have different layouts (trajectories);

- *directional vectors* - because between head-end positions can be drawn an infinity of curves, with these vectors is defined a certain one, using two vectors, each corresponding to a head-end position ***(AA ', BB')*** .

- *curve parametes* - Bezier curves present a specific parameter ***t,*** associated to trajectory generations; ***t∈ [0 .. 1]***, domain margins correspond to *head*(***t=0***) and *end* (***t=1***) positions.

Notifications

● equations defining the Bezier curves can be reversed to change curve`s trajectory direction; this is accomplished by reversing the positions of *head-end points* and *directional vectors* within the modeling equation.

● same effect can be achieved by changing the direction of variation of the parameter ***t***; the natural sense is obtained for ***t∈ [0 .. 1]*** and going over backwards is achieved for ***t∈ [1..0]***. When is required to reverse a Bezier curve, is recommended to change the modeling equation, and not the sense of ***t*** parameter. Changing the sense for the parameter is somehow against definiton, but can be implemented in programming with an additional workload, which can easily be avoid by reversing the modeling equation.

● directional vectors are always tangent to the Bezier curve, but not always their sense is the same as the one imposed for trajectory generation by ***t*** parameter; so, the directional vectors may have symmetrical positions to head-end positions, according to modeling equation.

● Bezier curves are *undertension curves*, and therefore, generating trajectory discret positions with a constant increment ***t*** (***t/10*** example) will not provide equal length sectors.

● these cases provide degenerate Bezier curves:

• at least one directional vector has length 0;

• restricting the definition domain: for example $t \in [0.2 .. 0.5]$. In the case of ellipses, restricting the domain of definition leads to obtain ellips arches, while specialized theory doesn't provide concepts for Bezier arches *(sectors)* ;

• extending the definition domain: for example $t \in [-200 .. 3.7]$.

(*) theoretical, one can obtain degenerate Bezier curves, but they don`t have practical relevance!

1.3. Concept ideas and paper's structure

This article presents important criteria of Bezier curves algoritmics, and brings together characteristic features difficult to found, or generally dispersed, because of their powerful programing character. Issues and manner of presentation are based on experience of implementing these curves in graphics programs, and thus there are not exposed only theoretical concepts but specific details of programming graphics.

Thus, the article is addressed to programmers who want to deepen Bezier curves, and experts from academia, to see how these curves folds practical applications.

The structure of this article : the introduction part short briefs on the requirements that triggered the appereance of Bezier curves, and also specific parameters and terminology. In the following chapters there are presented common graphical operations with Bezier curves, and in the end there are stated our conclusions and future research is revealed.

2. Our approach

Bezier curves were studied in the elaboration of the thesis entitled "*Contributions to development of aided design technology for leather and synthetic products*" - Technical University "Gh. ASACHI" from IASI (Romania), project that developed solutions for computer assited design of leather and synthetics products. Thus, we aimed to create a

graphics library, which, among other specific routine analytical graphics, includes Bezier curves.

As for graphics, and less technical field of design, we follow an exposition of these curves in terms of programming, without putting emphasis on design details.

3. Common operations with Bezier curves

3.1. Elementary geometric transformations

Example of elementary geometric transformations : translation, rotation, and scaling (increase or decrease).

Submission of a Bezier curve to any of the above geometric transformation involves redefining new positions for the *four specific points:* two head-end points and the two ends of the director vectors .

Thus, geometric transformation of a Bezier curve is reduced to applying the transformation equations on specific points. *How modeling equations of Bezier curves are dependent on these points, and only by them, provided the applied transformation is necessary and sufficient.*

Elementary geometric transformation equations:

● ***translation*** that leads point ***A (xA, y)*** in ***A '(xA', y ')*** is characterized by the equations:

$$\begin{cases} x' = x + h \\ y' = y + k \end{cases} \quad \textbf{(28)}, \ (x,y) \in R^2, \text{ where } \begin{cases} h = xA' - xA \\ k = yA' - yA \end{cases}$$

● ***rotation*** of center ***O(0,0)*** and angle θ, which applied to a point ***P(x, y)***, leads to obtain the point ***P(x ', y')***, is characterized by the equations: $\begin{cases} x' = x\cos\theta - y\sin\theta \\ y' = x\sin\theta + y\cos\theta \end{cases}$ **(29)**

● ***scaling*** point ***P(x, y)***, with a value ***k***, from the origin ***O(xO, yO)***, leads to obtaining point ***P(x', y')***, characterized by the equations: $\begin{cases} x' = x0 + k(x - xO) \\ y' = y0 + k(y - yO) \end{cases}$ **(30)**

3.2. Intersection of two Bezier curves

Considering two curves C_1 and C_2 , with the set of discret positions P_i and Q_i determined by incremental parameters $i=1..n$.

To find the intersection point with some accuracy, is needed to intersection of two segments from each set. When determining an intersection point, for example between segments $[P_k,P_{k+1}]$ and $[Q_k,Q_{k+1}]$, is required a new incremental approximation of there curves, corresponding to the sectors between the two segments that caused intersection.

This method is repeated until the approximate length of segments is less than the required accuracy.

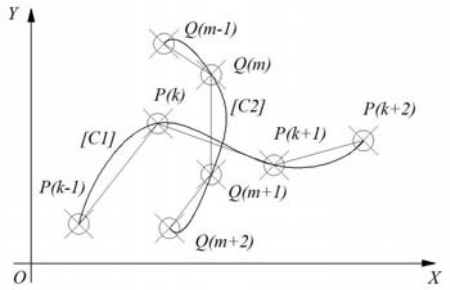

Fig. 21. Aproximative intersection of two curves

3.3. Finding the length of Bezier curves

Since there are no analytical formulas which express the exact length of a Bezier curve, it is required to make a discrete approximation of these curves with line segments;curve lengh will be the sum of all these discrete segments (infinitely small). As the number of segments is greater, the determination accuracy is higher.

Considering the curve C, with the set of discret positions P_i $i=1..n$, determined by a small increment, curve length is $\sum_{i=1}^{n-1} d(P_i, P_{i+1})$ where $d(P_i,P_{i+1})$ is the analytical distance between two points (*or the* ***i*** *segment length*).

3.4. Finding division point and breaking Bezier curves

When the length of the curve is known (*with a satisfactory accuracy*) to determine the position of a point at a certain fraction of the curve length is sufficient to generate the curve trajectory until desired length

is equal to the length of the generated trajectory. Point P_i, from the final elementary segment can be regarded as the point sought (*because generated trajectories are in fact segments*).

For example, considering the segments $[P_i, P_{i+1}]$, $i=1\ldots n$, each segment of length $l_i = d(P_i, P_{i+1})$, curve length will be $l_C = \sum_{i=1}^{n-1} li = \sum_{i=1}^{n-1} d(P_i, P_{i+1})$ **(31).** Considering a fraction of the length $l_f = f * l_C$ **(32),** where $0<f<1$, finding the appropriate point on the curve for length l_f is given by computing a restrictive sum $l_K = \sum_{i=1}^{k-1} li$ **(33)** so that $l_{k-1} \le l_f \le l_k$ **(34).** When the condition is respected, the point P_i is consider.

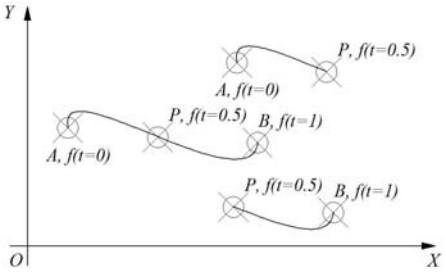

Fig. 22. Breaking a bezier curve

Dividing the curve at a point (*breaking position*) requires knowing the corresponding parameter value. The position of point P_i on the curve is characterized by a parametric value, and these variables, the position and the parameter, are computed during trajectory generation, so they share the same accuracy (*approximation method`s accuracy*).

When determining the value of the parameter t_i, so $P_i=f(t_i)$, the parameter may be used to split the curve, by spliting the definition domain; in this way result two curves, showing geometric continuity (contact + first derivative) at the point P_i.

Dividing a Bezier curve at a parametrical position $ti \in (0, 1)$, will lead to two Bezier curves with complementary definition domains : $t1 \in [0, ti]$ si $t2 \in [ti,1]$; $[0, ti] \cup [ti,1] \equiv [0,1]$ **(35)**

3.5. Position of a point relative to a Bezier curve

In relation to a Bezier curve, a point can be outside or on the curve. To determine its position, is used to find discrete positions of the Bezier curve, and so there results a sequence of positions P_i $(i=1,k)$. For each $[P_iP_{i+1}]$ segment, is determined a distance d, between point A and the middle of the segment $[P_iP_{i+1}]$. From all $k-1$ distanced is considered the smallest distance. If accuracy is considered rough, curve can be subject to a new discrete division between points P_n and P_{n+1}, coresponding to the segment that triggered the smallest distance d., $1 \le n \le k-1$. The process is repeated until the length of the segment $[P_nP_{n+1}]$is small enough, so the needed accuracy is reached (**figure 23**).

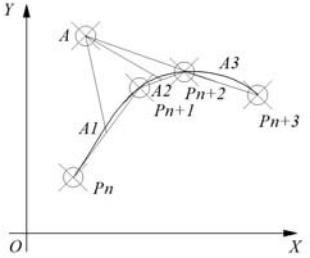

Fig. 23. Position of a point relative to a Bezier curve

The final distance d associated with this segment reflect the position of point A from the curve: if $d<\varepsilon$ then it may be that point A is on the curve, otherwise, the point is outside the curve. The tolerance ε can be set, depending on the desired accuracy.

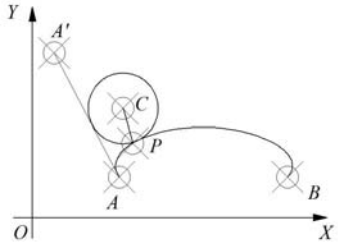

Fig. 24. Finding the center for a circle that is tangent to a segment and to a Bezier curve

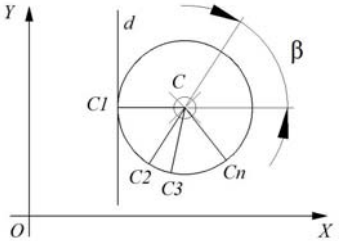

Fig. 25. Finding the tangent value to a circle for a specific **β** angle

3.6. Connection between a segment and a Bezier curve

Considering the segment ***[AA']*** and the Bezier curve ***(A,A'',B'',B).*** Connection circle of center ***C*** and radius ***r,*** is tangent to the two entities, centered at a distance equal to the radius form segment ***[AA '].*** Thus, the circle center position is along an axis distant ***r*** from the initial segment.

In point of tangency between the circle and Bezier curve, there is continuity of first derivatives, and thus the radius direction is perpendicular to the tangent to the Bezier curve at that point.

Is required to find the discret positions for the Bezier curve, and take in order each small segment into consideration, until the direction of the segment and the corresponding circle tangent are equal, or the difference Δ between these two directions checks the innequality $\Delta <= \varepsilon, \varepsilon \to 0$ **(36)**.

Thus, segments determined from discret positions are verified using formula ***(36)***; while bezier tangent is easy to find, because it has the same orientation as the approximate segment, finding circle tangent is a little triky; it requires finding a connection between a polar system and the cartesian system, because segment's coordinates are in a cartesian system, while a circle tangent depends on radius angle, which is relative to circle center, and so there is a polar system located in the center of the circle. Considering that d is parallel to OY, is needed to find the circle tangent at a given ***x*** distance, from axis ***d*** (**figure 25**); $x \le 2r$. For the ***x*** distance is found the corresponding trigonometrical ***β*** angle of the polar system; between ***x*** and ***β*** is the following connection : $\angle\beta = \angle(C_1CC_n); d([d], Cn) = x$ **(37)**.

Thus, for a given distance is determined point ***Cn*** on the circle ***C*** located at distance ***x*** from the axis ***d***.

$x = CCn\cos\beta = r\cos\beta \to \beta = \arccos(\frac{x}{r})$ **(38)**. Tangent value is $\beta+90^0$ **(39)**.

Distance ***x*** is the distance between discret position ***Pi*** and axis ***[AA']***.

Thus, if the incremental position is ***Pi*** and the difference between the tangents to the circle and bezier curve checks **(36)** it is considered point ***Pi*** is the final contact point**.** For a higher precision, bezier curve can be subject to a new discret aporoximation between points P_{i-1} and P_{i+1}. After common point of tangency is found, the position of the center circle is perpendicular to the Bezier curve at this point, at a distance from it equal to the radius.

Also, the bezier curve might be breaked around the common tangent position ***Pi***.

4. Conclusions and future research

1) Bezier curves presents an area of interest for programmable graphics and simulated computer graphics. Generalize of these curves include higher order bezier curves, for planar (2 axis) graphics, or bezier surfaces, for three-dimensional graphics.

2) From these types of curves, the most commonly used are the cubic one, found in most graphics applications, and inside the structure of digital characters sets (*fonts*), used to display *text* on computer screens.

3) Research on Bezier curves involves obtaining superior graphics, but documentation is time-consuming as theoretical concepts associated with these geometric elements are hard to find.

4) Information sources on these curves do not cover many aspects and applications, as Bezier curves are generally presented in terms of compatibility with a particular event, treated individually; for example, can be found only intersections issues or modelling equations.

5) Notions of Bezier curves theory are small and dispersed.

6) During research was studied a significant amount of data for these curves, and generally, after understanding the principles outlined, it was necessary to define our own methods.

Fig. 30. Variants of sPline interpolation

7) Thus, this article presents bezier curves not only theoretically, but in terms of their implementation within an application, being treated sometimes notions of auxiliary fields, but needed for source code development.

8) Generally, creating a graphics library based on Bezier curves uses 10% routines related to these curves, and the difference is occupied by auxiliary procedures required for programming. Thus, the techniques

presented in this article are intended for programmers in the graphics, and to those who want to deepen the concepts and applications of Bezier curves.

9) In the future, we want to focus efforts on *improving* the *spline interpolation,* because the variants offered by current software sollutions reveal an inadequate character of interpolation **(figure 30),** meaning that the final curve varies too widely around the interpolated positions.

10) So far we have managed to reduce these oscillations for static curves, but real-time interpolation is still failing, so this algorithm will be published after solving this aspect.

Aknowledgements

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TESTING AND CALIBRATING AN ORIGINALL SOFTWARE DESIGNED TO ESTIMATE CONSUMPTION NORMS FOR LEATHER AND SYNTHETIC PRODUCTS, USING COMPACT PARTS DRAWING METHOD

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Abstract: Relevant material estimation, since design stage for leather or a synthetic product, is an important issue, because material's costs represent a significative percentage for the sale price of that product (footwear, bags, automotive, etc ...). Through time, the theory specific for this products, and also the manufacture sites for leather and synthetic products, suggested different methods for material norm estimation; this article presents software testing concepts for optimazing computer applications, specific parameters for compact parts drawing method, and a study of their influnece on the final value of material estimation, to establish the optimal working domains. Research focusing for this purpose is justified by the fact that this method has a wide application in industry, but often provided results don't match real values, with hard to tollerate deviations.

Keywords: assisted norm, leather, synthetic, compact drawing, testing, calibration

1. Introduction

1.1. Actual usage of different estimation methods for leather and syntethic products

There are 4 common methods used to estimate needed material for manufacturing leather and synthetic products; there methods had been developed by academics, or by technicians from manufacturing. Generally, only one particular method is used for estimation, because each method presents a certain relevance and requires specific conditions, which involves that the personnel interested in norm estimation to use frequently the method that reflects best the usage for the value of the estimation; academics prefer the method concept, to expose design particularities to students, while technicians from manufacturing prefer a method that provides a correct result within a very short period of time.

- *method based on sum of all rests*

This method is based on the ***medium value of nesting coefficients*** for all parts of one article, and on ***percentage values*** of common ***rests*** after the cutting :

• normally rests *Dn* - rests between cutted parts of same shape and size;

• marginal rests *Dm* - rests because of the differences between parts shape and material shape;

• pattern rests *Dt* - rests between parts with different shape;

• defects rests *Dd* - rests because of the need to go around material imperfections;

• bridge rests *Dp* - rests based on the distances between cutting dices;

From all methods, this is the most complex, because it takes into consideration design specific values, nesting coefficients, material quality index, cutting technology, material shape, etc, and that's why this method is suitable for the academic environment.

● *method based on parts compact drawing*

All parts of one article are drawn over a piece of paper as closed as possible, to create a compact group. For material estimation, there are to possibilites (**figure 1**) :

• ***bounding rectangle*** - around the compact parts group, is drawn a rectangle; at the surface of this rectangle is added a correction percentage, around 5-10%, to approximate cutting rests as marginal and defects, depending on the leather type; in this case, estimation norm (***Nc***) will be : Nc=S(1+0.1)=1.1S **(1)**

• ***squares*** - over the compact parts groups is drawn a network of squares, with side length usually 1dm; ***Nc*** will be equal with the area of all squares that intersect the original parts.

'Compact drawing method' is simpler and much faster than the 'method based on sum of all rests'. Estimation based on the gabarit rectangle is used in the academic environment, while the one based on squares is used in manufacturing.

This method is simpler because doesn't require values, but only a compact drawing of all parts, and this particularity makes it to deliver results pretty fast, and so it is frequently used in manufacturing. The gabarit rectangle estimation is used in the academically environment, but not as much as the 'method based on sum of all rests', because doesn't involve as much theoretical aspect as this method. Theoretical aspect are required in classrooms, to help students assimilate concepts of leather and synthetic articles design.

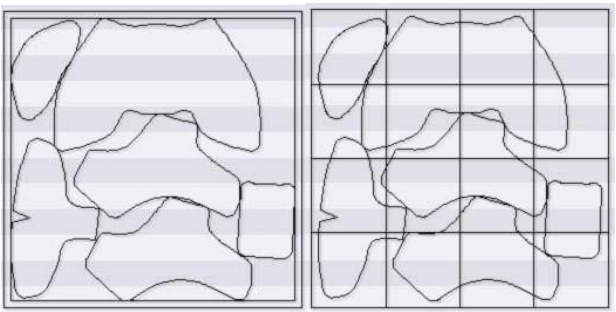


Fig. 1. Illustration of material estimation possibilities, based on parts compact drawing: *left* - bounding rectangle variant, *right* - squares variant

● *method based on experimental cutting*

After experimental (*test*) cutting, from the surface of used material and the surface of cutted parts can be calculated a ***cutting coefficient***.

For example, if leather surface is 200 dm^2 and parts surface is 152 dm^2, the value for the ***cutting coefficient*** will be :

$$I_f = \frac{Material\ surface}{Parts\ surface} = \frac{200}{152} = 1.315 \qquad \textbf{(2)}$$

Material estimation with experimental cutting involves multiplying the surface of all parts of an article (***Sn***) with the cutting coefficient (***If***); estimation norm will be : $N_c = S_n \times I_f$. **(3)**

This method is the most relevant one, the estimated value being pretty close to the real one, because the method is based on experimental cutting. It was a common method in industry, estimation for a new product was easily determinate inside the cutting or creation department.

Today, design departments aren't always near cutting departments, which makes this method to lose ground.

1.2. Concept idea

This article presents criteria of software testing for a program originally designed to estimate consumption norms for leather products and substitutes, using the *method of drawing compact.* Method itself is not

complex, but shows wide applicability in industrial environments because the estimation process is very short (~ 1 minute). Because of inconsistencies between the estimated value and the actual consumption norm (real values), we tried to reduce the deviation of this two values, intervening on specific estimation process parameters.

In the following, there is a short brief on software testing, and a presentation for all modelling parameters of the compact drawing estimation method. There are case studies developed for defining the optimal domains for the modelling parameters, looking to obtain values as close as possible to the real ones (relevant values).

2. Testing and calibration concepts for software solutions designed to estimate materials for leather and syntethic products

Testing aims at setting the optimal working parameters of a program to provide process values (for example, estimated values for material consumption), in less time possible. It is used to test application with different parameters sets whose accuracy varies in a wide enough area, aiming at that, after testing, this field will be limited as much as possible. Once the optimal domain had been found, there had been defined recommended values for parameters, to obtain relevant results. Application *calibrating* means finding the most suitable values from the optimal domain that will allow the process to provide relevant result. Otherwise, provided results are just theoretically corect, but with no practical relevance.

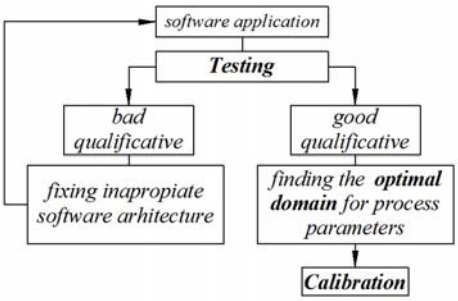


Fig. 2. Stages for software testing and calibration

Thus, software *testing* is done to *optimize* software behaviour, targeting aspects of general programming, connections between program structures and user interfaces.

Calibration software is done in order to obtain *real values* for the simulated process, especially when designed application is for a technical enviroment.

Therefore, building applications for material estimation, requires testing for a smooth functioning, while calibration ensures that sofwtare provides relevant solutions.

Testing a computer program (application) includes:

• *application stability check* (although subroutines work properly, their implementation in applicatin structure might be made poor, resulting in reduced application stability);

• *method stability check* (it aims to achieve the same result, by repeating processes with a constant set of parameters);

• *setting the optimum operating parameters* (calling parameters sets can promote quality in performance detriment, or vice versa, so it is necessary to establish optimal values for these parameters;***when determining material consumption, software may perform faster with low resolution parts, while higher resolution parts will provide better results; optimum domain is for faster computing, so, for lower resolution parts. This domain can be found by targeting results within a tollerated devation domain from the real values***).

Calibration for a computer program designed for estimating the consumption norm means that the software will provide relevant result, or as close as possible to the real ones. Thus, there is required to study the influence of specific estimation method parameters over the final results, for comparison with real values of consumption norms, or values provided using other estimation methods.

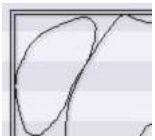
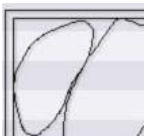
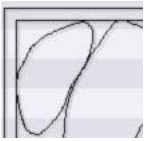
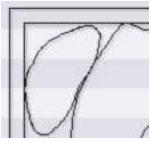
3. The influence of parameters for the method based on compact drawing over the final value of material estimation

● *Bounding rectangle variant*

Specific parameters of this variant is the correction, used to cover losses due to marginal or defect rest. The following table (**table 1**) centralizes specific data for this study. For different values of the correction percentage, there are specified material estimation and the ratio

of this value and total patterns area, from the product. The table also includes the design for the variant, and a specific detail of each image to suggest the difference in size between the bounding rectangle, and one obtained by modifying the area of the 1st rectangle by an amount equal to the correction percentage.

Table 1. Material estimation based on finding the bounding rectangle variant

p [%]	5	10	15	20
Nc [dm2/per]	15.97	16.72	17.49	18.25
Variant design				
Variant design *(detail)*				

Notifications

- Norm of consumption rises with the correction percentage ***p***.
- theory recommends that ***p = 5 .. 10 [%]*** **(4).**

● *Squares variant*

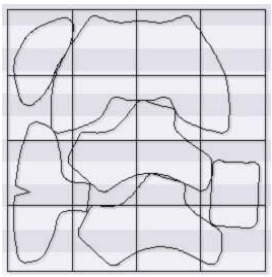
Theoretically, this variation doesn`t have specific parameters. However, after practical estimation using this method, have been suggested the following specific parameters:

- square side length ***dl***; frequently, ***dl = 1 [dm]*** **(5);**
- validation condition (counting) for squares from the network, depending on the minimal intersected percentage.

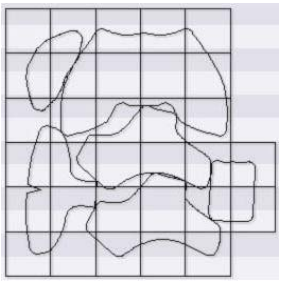
Need to study the influence of different values of these parameters on material estimation value is based on clear differences in practice between the real values of consumption norms and those obtained by this method.

Studying the influence of square`s side length was based on analysis of **table 2**; validation of a square was made for any intersection with drawn parts.

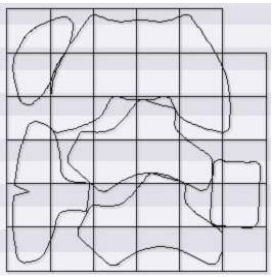
Table 2. Material estimation based on squares variant



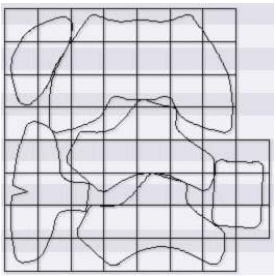
1.00 | 16.64 | 1.6



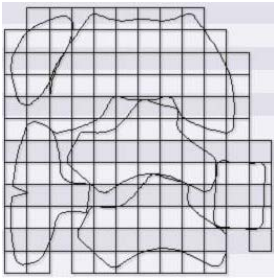
0.75 | 18.72 | 1.8



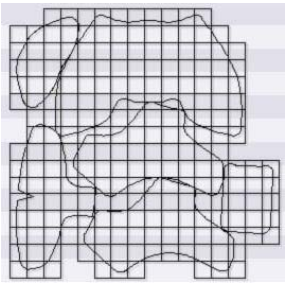
0.67 | 16.18 | 1.5



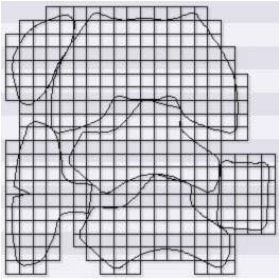
0.50 | 15.34 | 1.5



0.33 | 15.02 | 1.4



0.25 | 14.30 | 1.4



0.20 | 14.02 | 1.3

(*) note
0.20 | 14.02 | 1.3
=
dl | Nc | Nc / Aset

For a better use of available space in the table above was used an abbreviated writing for square`s side length ***dl*** [dm], ***material consumption***

[dm^2 / per] and the ratio between material estimation and total area of article parts.

Notes

- estimative value for material consumption increases with ***dl*** value, because approximation becomes *rough;*

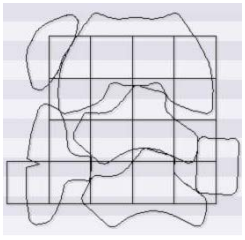
- declining ***dl*** value until a low standard value (~ 1mm) provides for this method a result equivalent with total area of article parts, because a network based on small squares approximates better the shape for the nested parts.

Studying the influence of minimal required intersected area for a square is based on avoiding accidental counting of a square (unfavorable case), illustrated in **figure 3**.

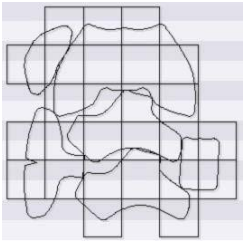
Fig. 3. Accidentally square counting
intersected surface is too small

Quantification for the ***intersection value*** was achieved by computing the sum of all intersections between a square and drawn parts. ***Validation condition*** was established by imposing a *lower acceptance* value for the intersected percentage area. To determine the optimal value for the *lower acceptance* had been observed how the network evoluates for different values.

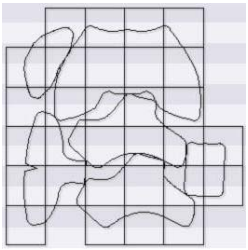
Table 3 : Square network evolution for different values of the *lower acceptance*



0.75 | 50% | 9.95 | 0.9



0.75 | 25% | 15.21 | 1.4



0.75 | 10% | 17.55 | 1.7

(*) 0.75 | 50% | 19.13 | 0.9 = dl | p | Nc | Nc / Aset

Notifications

- Number of squares decreases significantly as the *lower acceptance* increases;

To set the optimal value for *lower acceptance* we compared the result from **table 3** with the result specific to square side size length influence (**table 2**).

Table 4 : Setting the optimal value for the *lower acceptance*

0.75 | 50% | _9.95	1.00 | 16.64
0.75 | 25% | 15.21	0.75 | 18.72
0.75 | 10% | 17.55	0.67 | 16.18
A) specific data to lower acceptance	*B) specific data to* ***dl*** *influence*

From the ***A*** data set, the closest value to ***B*** data set for ***dl=0.75[dm]*** is the 3rd one, relative to a ***10%*** *lower acceptance.* **(6)**

4. Relevant conclusions and new research directions

1) Software testing and calibration for the material estimation method based on parts compact drawing is a necessary step, even critical, in the development of aided design technology.

2) After testing, we obtained an application that works correctly, following step by step the stages of this method provided by specific theory. Calibration was achieved after running case studies under the application, based on test sets of leather and syntethic product parts.

3) The ultimate goal of calibration is to make an application that is amenable to industrial environmental requirements.

4) By calibration we restrained the defining domain for process parameters, focusing on achieving relevant values for material estimation of leather and syntethic products.

5) The relevance of this method was determined by comparing results to those of alternative programs, using other methods for material estimating.

6) Future research will be focused on developing software solutions for leather manufacturing, regarding cutting automatization.

Aknowledgements

This work was carried out with financial support of the project ***EURODOC „Doctoral Scholarships for performance research in Europe”***, funded by the ***European Social Fund*** and the ***Government of Romania***.

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PREFABRICATED INSULATION PLASTER BOARD AND PROCESS FOR MAKING IT

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[2]*The Palace of Children Iasi, Iasi, Romania*

Abstract: *This paper concerns a prefabricated insulating two-layers element, made by placing polystyrene insulation board over gypsum board reinforced with glass fibers dispersed in a freshly poured formwork used to clad the interior of exterior walls, buildings with superior hygrothermal behavior for residential, administrative, social-cultural and industrial buildings, with relative humidity below 60%, in order to reduce consumption of conventional energy.*

Keywords: insulation; prefabricated elements; reinforced plaster boards

1. Introduction

The outer walls have a significant share in the envelope (surface separating the outdoor heated volume) of a building. Thermal insulation of exterior walls can be achieved by laying insulating layer on the outside or inside them. Location on the inner surface is less efficient in terms of thermal insulation capacity, resulting in restricted use of this solution. Compensation is achieved by implementing simple mounting technology, lower cost price and unchanged facades.

In the inner cladding is currently using the following solutions: polystyrene, polyethylene film, gypsum board, autoclaved aerated concrete and cement-lime based plaster.

These solutions have the disadvantage that: in addition to high energy consumption embodied, not eliminate risk of condensation due to thermal bridges at the junction elements.

The problem solved by the invention is to achieve a prefabricated insulating two-layers plaster board inner cladding with hygrothermal behavior above.

Insulating plate is such that the joints between the tiles to make the tongue and groove, substantially reducing the risk of condensation. Prefabricated element used in the inner lining is made of two layers, first layer of resistance to the room, made of plaster reinforced with fiber glass dispersed the longitudinal edges and transverse reinforcement for achievement gaps between pre-cast elements and the second polystyrene insulating layer provided with tongue and groove for joining.

Prefabricated structural components made of these two layers is simple and easily mounted with adhesive bonded for polzstzrene and fixing dowels.

By applying the invention it is obtained the following advantages: no condensation using tongue and groove type joints, increasing hygrothermal behavior of external walls, using the inner cladding for buildings with special architecture, historical monuments and walls are the joints between sections.

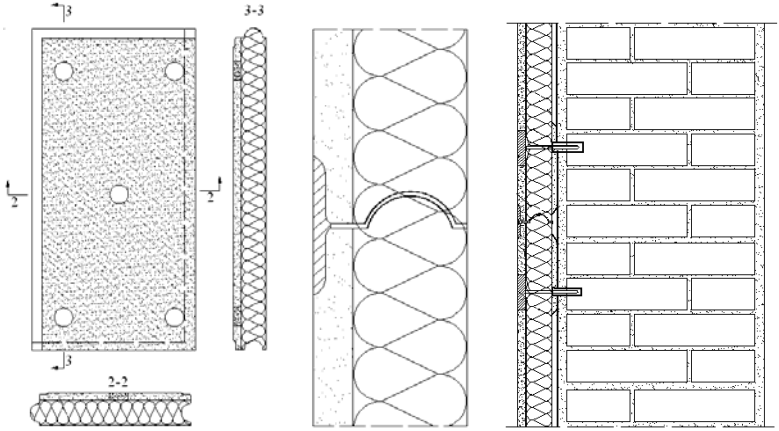

Fig. 1. Panels structure

2. Fabrication Technology

The prefabricated insulation two-layers plaster board consists of two parts joined by brazing directly as follows: gypsum board over fiberglass reinforced dispersed, freshly poured into wooden decking, plastic or stainless steel, sitting on a table, insulating board overlaps polystyrene produced with the tongue and groove ends, resulting in a modular plate after plate size plaster reinforced with fiberglass dispersed.

After bonding the inner surface of the wall with adhesive for bonded polystyrene is created only five cores in gypsum board, the spaces created by coring plugs are inserted for insulation which are designed to fit and support positions established prefabricated two-layers. Space left after ordering plugs will dull the fresh plaster paste mixed with glass fiber, while the finishing operation to be done with the laps of the prefabricated two layers plaster board joints.

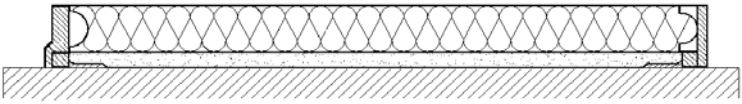

Fig. 2.

3. Conclusions

The prefabricated insulation two-layers plaster board eliminates condensation by using tongue and groove type joints and increase Hygrothermal behavior of external walls.

Insulating newly created element has a low energz consumption at both the manufacturing and assembly is easy, requires no additional work for installation (scaffold), so the manufacturing cost and installation.

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ELASTIC PARTITION WALLS

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Abstract: *This paper refers to the achievement of a lighter elastic partition, use in partition, the role of increased sound insulation index (R). Such walls are made with a metal frame (pillars sections of sheet metal 0.7 mm cold-formed) joined through rubber parts, aimed dissociation of the two sides of the wall and air noise attenuation. Closing on both sides of the elastic wall, is made easy with disperse reinforced densified plaster boards.*

Keywords: elastic partition walls; ruber parts; cold rolled; air noise attenuation.

1. Introduction

Requirement acoustic internal partition walls, modern frame made of mineral wool and plaster-cardboard is achieved by a judicious design which takes into account the amount, characteristics and location of these components in the easy walls structure.

In residential buildings, noise attenuation is necessary to eliminate discomfort that may have repercussions on people's health and work efficiency.

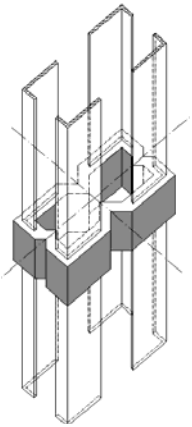
For designing of the bulkhead partition walls, are known walls made of metal profiles, gypsum-cardboard plates and thermal and sound absorbing layer placed between the plates.

These existing bulkheads have the disadvantage that is rigid link elements that lead to a poor acoustic attenuation.

The technical problem solved by the invention consists in the production of elastic bulkheads for enhanced attenuation of airborne noise by an introduction to pillars of the walls, elastic pieces of rubber, and on both sides, reinforced densified plaster boards.

Light elastic partition walls solves the technical problem in that: the process of making the walls, are available at certain distances, the horizontal pillars made of cold rolled steel profiles, assembled by means of elastic rubber parts, with a degree of flexibility, mounted at some distance in the vertical plane, forming a flexible structure able to attenuate airborne noise.

By applying the invention it is obtained the following advantages: increased acoustic attenuation due to elasticity of the new system created, dissociation of the two sides of the wall by using pillars which are assembled through rubber parts; easy assembling and mounting steel structure of the walls;



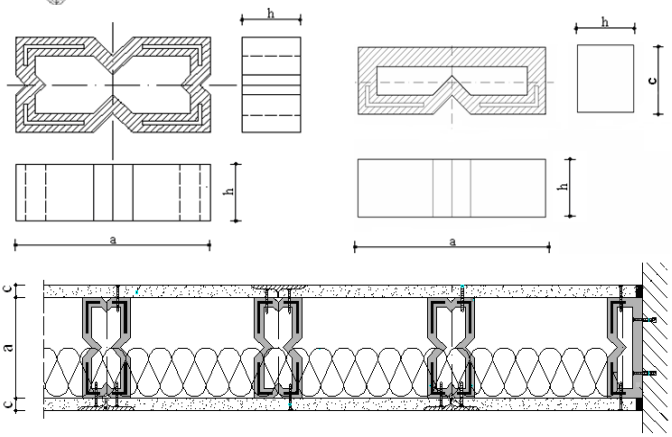


Fig. 1 **Fig. 2**

2. Manufacturing technology

Making process of this invention consists in the production of the rubber pieces mold, having the size and shape as shown in Figure 2; draw

axis on the plan where wall will be mounted; fixing the perimeter elements of the bulkhead; assembling and fixing pillars (Figure 1) formed of rubber parts and sections, cold rolled sheet; mounting on one side of the wall of disperse reinforced densified plaster boards through-drilling screws; mounting sound absorbing layer; mounting closing disperse reinforced densified plaster boards; finishing joints between the plates; siliconing contour perimeter on both sides of the wall.

3. Conclusions

Pillars that form the wall structure are made up of rubber parts with certain elasticity, which are obtained by injecting rubber into specially designed molds.

Plasterboards reinforced disperse with glass fibers are densified by introducing a quantity of silica in the plaster composition, process that helps increasing the ability of acoustic attenuation.

Through the assembly of the system (use rubber parts in the structure of pillars) it is obtained dissociation of the plates situated on both sides of the bulkhead, substantially attenuating airborne transmission.

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REINFORCED PLASTER BOARD AND PROCESS OF MAKING IT

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Abstract: *This paper refers to a plaster board, reinforced on two directions and making process, consists of two networks fiberglass reinforcement pre-stressed over densified plaster composition is poured. Between the two networks are provided spacers fittings of the same material, together forming the reinforcing enclosure. The board is designed on construction to create the inner bulkheads, self-supporting or interior cladding on the exterior walls, on the false ceilings in buildings located in areas with high seismic level.*

Keywords: reinforced plaster board; pre-stressed reinforcement; internal partition walls; false ceilings.

1. Introduction

In construction, the requirements for strength, durability, simple and fast execution, lead to minimum cost design and adaptation of new technologies for manufacturing of fibers reinforced composite materials.

Improved properties fiber reinforced composites are appreciable compared to tensile or compression applications. The achievement is due to conditions for the acquisition and redistribution of effort applied to the matrix. Composite fibers can take effort after cracking, the strain values far above the simple matrix failure. Behavior that facilitates distribution efforts, almost plastic behavior of tensed area, while on compressed area we have an elastic behavior. Fibers reinforcement of composites increases the tensile strength of the shock.

For designing of self-supporting interior walls are known plaster-cardboard plates.

These plates have the disadvantage that: do not provide increased resistance to shock, do not provide sound proofing, cracks often occur during operation at the junction between them.

The technical problem solved by the invention is to design a densified plaster board, fiber reinforced glass on two directions and establishes a process for making it.

Reinforced plaster board, pre-stressed on two directions, remove the above-mentioned disadvantages in that the purpose of performing internal bulkheads and interior cladding, the plate is obtained from a reinforcement disposed centered on two levels with two fiberglass mesh centered by some spacers, reinforcement that is pre-stressed on two directions using a clamping jaw system of nets and special devices for pre-stressing reinforcement.

In process of making it, pre-stressed reinforcement is placed in wooden or plastic formwork, pouring densified fluid plaster over, leaving on the ends of the plate oversupply reinforcement.

By applying the invention it is obtained the following advantages: increased resistance to shock by pre-stressing reinforcement improved sound proofing, due to plaster densification, elimination of cracks in the joints of elements by overlapping reinforcement excess.

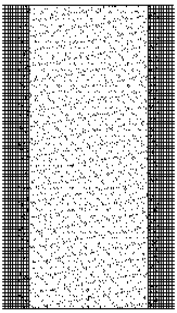

Fig. 1

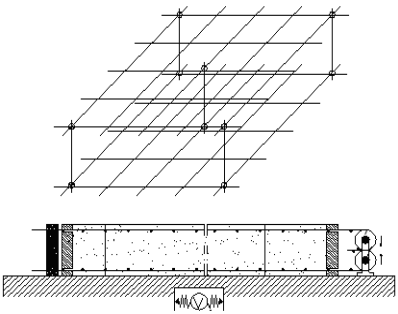

Fig. 2

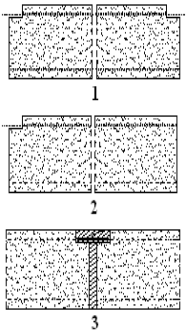

Fig. 3

2. Manufacturing technology

According to the invention, the plate is obtained from a centered reinforcement, located on two levels as a fiberglass mesh, centered by some spacers, reinforcement that is pre-stressed on two directions using a clamping jaw system of nets.

To obtain a reinforced plaster board, it is used the method of casting fluid densified plaster composition over the centered reinforcement in formwork made of wood or plastic with adequate geometry, field / end,

pouring plate on the horizontal, with reinforcement pre-stressed. The densified plaster composition will be vibrated using plaster surface vibrator.

The joint is achieved by overlapping reinforcement excess of the plates and the finishing is made with plaster composition. Plates thus created will be used for bulkheads or interior cladding of external walls, where is required a better sound proofing and greater resistance to shock (surgery rooms, gyms, bedrooms, libraries, conference rooms, restaurants, laboratories) etc.

3. Conclusions

Reinforced plaster board is obtained from a reinforcement enclosure, by reinforcement arranged on two levels with two fiberglass nets, centered by some spacers, pouring fluid plaster composition into a formwork, at the ends having a reinforcement excess.

Reinforcement consists of two fiberglass mesh pre-stressed on two directions using a clamping jaw system of nets and special devices for tensioning fittings, placed in a wood or plastic formwork pouring densified fluid plaster over

The upper reinforcement excess overlaps on the bottom plate reinforcement excess, ensuring joints continuity in the created wall.

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RELIGIOSITY AMONG STUDENTS AND THE INFLUENCE OF THE LEGACY OF THE PREVIOUS GENERATIONS

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Abstract: Based on the reasearch conducted on a sample of 137 students, 4th-7th grades from 'St. Luchian' School, at Moinesti, Bacau County, Romania, we have studied the religious experiences of these individuals. In order to get the accurate information we used a structured interview format. The data resulted were included in the five religious components (Glock, 1962): religious practice segment, cognitive (intelectual), experiential, ideological, consequential-consequence segment (Willaime, 2001).
The findings emphasized a high degree of religiosity influenced by the combined actions of family and school, as a result of Religion teaching. The informal ritual dimension was well expressed. More than half of the questioned subjects stated that they prayed to God, fasted, went to confession, the process being intensified over time as they went later to high school.
The family experience and school religious education have clearly and positively influenced the student behaviour.

Keywords: students, religious fervour, religious dimension, education.

1. Introduction

The contemporary research in Religion is based on those aspects that include most of the segments of the religious phenomena and uses indicators that measure the basic components of faith, ideology, tenets, religious beliefs.

In the study of the religious practice (specific rituals), the measurement elements for the present research study were: the frequency of church-going, prayer, fasting (special diet periods), going to confession, the presence of icons in one's home, etc., private or public religious practices that prove the knowledge and practice of Christian faith.

The cognitive/intellectual segment exhibits the following indicators: having religious books in the home, talking about religious matters, watching religion TV shows.

The experience or practice of faith segment is represented by the following indicators: faith in God, emotional experiences connected to God etc.

The ideological or dogmatic dimensions are related to: information about the holy relics of Saints and the belief in the afterlife.

The regulations segment, reflecting consequences and norms of the religious practice, reffers to the positive effects on the human behaviour, helping other fellow beings, being sympathetic, kind etc.

The degree of social involvement in the life of the community can be a passive-conformist or a creative–changing one (implication), indicated by the self-identification of the believer with faith he or she is affiliated to.

The social trait of religion if given by the degree and the manner the faith is transmitted to one's offspring/to posterity and it can measured by the number and level of educated families who ensure that children benefit from the religious instruction in school and/or church.

A research study was performed in 2008, on a sample of 137 students, from ,St. Luchian'school in Moinesti, Bacau County, with the aim of emphasizing the evolution and practice of religious faith depending on the sex and age.

The research study appeals to the sociological inquiry, using quantitative statistical methods and employs the techniques of structured interview in the invetigation of students' faith and religious emotions. The study can viewed as fundamental assessment research because its major aim is to obtain new information and develop the theory, as well as to analyze the effects of different actions undertaken in society.

The thematic grid was structured based on the significant theological, philosophical, moral, behavioral values and dimensions that are for the most part measurable.

The assumptions of this research are:

1. Religious principles are translated into behavioral values.

2. Religious practice is influenced by school and family.

3. Frequency of church-going and private religious practice are of major significance for the individual's life.

The purpose of the present research is to identify how some of these elements can influence the practice of religion in the formative period, contributing to the assimilation and internalization of the moral-religious norms.

The general goals of this research are:

1. The Identification of the general perceptions on the importance of the religious values for individuals that often are one of the channels through which social deeds are done.

2. Identifying the contribution of religion to the shaping of the individual conscience, especially to the birth of the religious awareness.

2. Methods

The research was conducted on a sample of students selected from among 4th-7th grades, in order to highlight some of the variability generated by the age and level of education of the subjects (see Table 1).

Table 1. The classification of subjects according to sex, age, background, parents jobs and education.

Class	No. of students	Sex				Age	Background			
		Masculine		Feminine			Urban		Rural	
		No.	%	No.	%		No.	%	No.	%
IV	29	16	55	13	45	9-12	15	52	14	48
V	34	16	47	18	53	11-12	9	27	25	73
VI	43	21	48	22	52	12-13	32	74	11	26
VII	31	19	62	12	38	12-14	27	87	4	13
Total	137	72	53	65	47	9-14	83	61	54	39

Classification of students according to their parents' occupation																			
Mother										Father									
Intellectu-al		Office clerk		Worker		No job		No mother		Intellectu-al		Clerk		Worker		Unemployed		No father	
no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
8	28	11	38	3	10	7	24	-	-	8	27	4	14	11	38	6	21	-	-
-	-	3	9	15	44	13	38	3	9	1	3	29	85	3	9	1	3	-	-
13	31	7	16	11	26	12	27	-	-	10	32	13	42	2	6	-	-	6	20
9	29	13	42	4	13	-	-	5	16	10	32	13	42	2	6	-	-	6	20
30	22	34	25	33	24	32	23	8	6	32	23	60	44	27	20	7	5	11	8

Classification of subjects according to parents' education											
Mother						Father					
Elementa-ry		High school/me-dium		College/ higher education		Elementary		High school/medium		College/ higher education	
no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
2	7	17	59	10	34	1	4	21	72	7	24
7	21	25	74	2	5	22	64	9	26	3	10
2	5	25	58	16	37	13	30	11	26	19	44
3	10	17	55	11	35	-	-	24	77	7	23
14	11	84	61	39	28	36	26	65	48	36	26

The sample has common characteristics such as belonging to the same cultural background (going to the same school), having aproximatively the same age (same age group: 9-14 years old), a fact that makes it a homogeneous group.

As mentioned above, the analysis is a quantitative one, by using the well-structured interview to gather the profound data, referring to the role of religiosity in the individual's life.

The thematic grid was organized based on the important dimensions of theological ideology, philosophy, moral and behavioral values, commom attitudes that are for the most part measurable.

Based on gender, feminine and masculine, the sample of students presents a slight predominance of boys (53%) over girls (47%). From this point of view, the most significant differences were found at children from the 4th-6th gradess.

Generally speaking, the age of the students varied between 9 and 14 years, but was naturally higher in the case of high school students.

The analyzed subjects were found to display similar educational and religious backgrounds, as a result of their belonging to the same social-historical class.

3. Results and Disscusions

The students' background can have an enormous influence on the future evolution of the religious beliefs and feelings, as 61% of the students come from the urban area while 39% from the rural zone. We must underline this aspect because the selected school for the research in located in the urban area and many students (39%) attending courses here are commuters who actually live out of the city in the nearby villages.

The two living and learning environments can deeply impact the religious beliefs of the students. Nowadays, the mutation, instability, numerical decrease of family members and the changes in the modern family life diminish the family unity and disrrupts the harmony between the individual members of this basic social cell, influencing the outward exteriorization of the religous fervour while also, diminishing social control on the particular individual behavior, on the religious beliefs and ritualistic practices.

In the rural areas, the (enlarged) patriarchal family unit is still very powerful and has a strog role in the lives of its members, the community still has a great impact and infulences its citizens, being very relevant on all the other aspects of life.

Religion organizes the spare time activites, establishes some of the daily, weekly religious-related routine and programmes, rites, etc. Religion exerts a very powerful controlling social role by imposing the social and idividual moral laws, managing and checking that they are upheld by society and impacting the most important decisions of the individuals (marriage, work-related decisions). In other words, religion has had a very

powerful influence both on the public and private lives of men and women (Madalina Voicu, 2007).

In the case of extended families, including many generations and among well-educated, intellectual famililies, religious education is undertaken first in the middle of the family. At this level, preserving and passing over religious values highlights the effort of emphasizing the importance of the awareness of the role of religion in preserving an authentic identity. In nuclear families, the teaching, learning and awareness of religious values falls in the capable hands of the school system, it is its task. Most parents consider that religious education received by their children in school is beneficial, especially considering the compensation of a lack of religious instruction during primary school' (Georgiana Szilagyi and Flora, 1998).

The postulate from which we started was based on the unanimously accepted idea in the sociological literature, that religiosity in its classic and traditional definition, suffers changes and loss of its role, because of the communist regime, of the secularization, which is a very significant fact in the urban area (Georgiana Szilagyi and Flora, 1998).

The five classic dimensions of religious implication used by Glock (1962) [the practical – ritualistic segment (what people do in order to express their faith in well set rituals); the cognitive – intellectual segment (knowledge of the religious theories and sacred literature/books); the experience/practice of faith itself (the emotional, spiritual life, the actual religious experience/practice); faith, religious ideology (ideological dimension); and consistency, consequential aspect, norm and consequence (Willaime, 2001) or the regulations segment (the consequences or results of faith, rules, the practice of religion in the public or private space)] and by Stark and Glock (1968), present in this research study, include, indicators connected to religiosity.

The ritualistic dimension contains a formal and an informal component. The formal segment includes the respect of the religious practices imposed by the church in the public space, while the informal component referrs to the personal, private ritualistic practices of the individual (Table 2).

Table 2. The Formal Ritualistic Dimension

Class	No. of Ss	Sex				Believe In God				I go to Church							
		Mas-culine		Femi-nine		Yes		No		Yes		No		Sun-day		Holy Days	
		no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
IV	29	16	54	13	46	27	93	2	7	28	97	1	3	19	66	10	34
V	34	15	44	19	56	34	100	-	-	30	88	4	12	29	85	5	15
VI	43	21	48	22	52	43	100	-	-	39	90	5	10	27	63	16	38
VII	31	19	61	12	39	31	100	-	-	28	90	3	10	23	73	8	27
Total	137	71	52	66	48	135	98	2	2	125	91	13	9	98	72	39	28

Among the interviewed subjects, almost all stated thier faith in God, the numbers being slightly increased. A number of two students from the 4th grade, representing 2% of the total number of subjects, stated that they do not believe in God.

The obvious 99% of the interviewed subjects said that they believed in God, indicating a higher score of the religiosity variable, thus displaying a high level of faith, as a consequence of family education, rounded by the Religion teaching in school.

When asked if they regularly went to church (this frequency being a significant indicator of the formal ritualisitc religion), 91% of the subjects stated that they did go to church, while 9% said that they did not attend the religious services.

There were differences with respect to Church attendance on Sundays (bigger number of students) or on Holy days (fewer number), a situation that corresponds to the participation of the whole community at these activities. Thus, 72% of the interviewed subjects took part in the religious services on Sundays while only 28% attend Mass on Holy days in church.

The analysis of the formal ritualistic component indicates, on the one hand, that almost all subjects believe in God and practice ritualistic forms of worship in public on Sundays attending Mass in church, while on the other hand, there is a lower frequency of church attendance during Holy days, that by no means indicate a lack of faith or bias to secularization.

According to Freud, attending Mass at church represents the 'possibility of enhancing the emotions of all individuals who take part in it ...',there is no other situation in which people's affections touch such high intensity than when all individuals are united in a gathering of some sort ...', the individual melts in the same feelings with the crowds until he or she is one with the mass of people and loses the perception or feeling of individual delimitation'. The communication between the individuals triggers the 'assimilation of the individual by the crowd'.

"Faith in God, love of Jesus Christ gains the quality of the ideal and the individual feels integrated with the other fellow, Christians by

identification. The church asks for more: on the one hand, the individual has to identify himself/herself with Christ and on the other hand, to love all the other Christians as Jesus loved them. The collective generated situation is completed in both directions: on the one hand, the identification happens in the same place where the loved ‚object' the libido exists and on the other hand, the love for this object comes to fulfill the identification. This mutual completion overcomes the condition of the masses. One can be a good Christian without ever thinking of placing himself/herlself in Jesus Christ's role, to love all people as He did. A weak man cannot have the ambition to rise at the high level of unthinkable greatness, to possess the capability to love that our Lord Redeemer, Jesus Christ had" (Freud, 2000).

According to Freud's psychological analysis, the religious unity during Mass and the common prayer generate a spiritual force and communion, an identification with the other Christians, eventually generating the desire for a higher morality. Generally, the child lives this feeling by taking part in the religious service and internalizing the Christian rules and practice that allow the accomplishment of the targeted goals.

Antoher aspect of the ritualistic component is the informal one and includes the private religious practice. The prayer performed during different moments of the day, the traditional ceremonials for the departed practiced at the cemetery, the advent and fasting, confession, praying before holy icons, all are indicators of the informal religious customs dimension (Table 3).

Table 3. The informal ritualistic component.

Total	Sex			
	Masculine		Feminine	
	no.	%	no.	%
29	16	5	13	45
34	16	47	18	53
43	21	48	22	52
31	19	62	12	58
137	72	53	65	47

Class	Prays																	
	In the morning						At noon/In the afternoon						In the evening					
	Yes		No		Rarely		Yes		No		Seldom		Yes		No		Seldom	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
IV	23	79	5	17	1	4	17	59	11	38	1	3	27	94	1	3	1	3
V	18	53	14	41	2	6	20	59	13	38	1	3	33	97	1	3	2	5
VI	23	53	18	42	2	5	24	58	16	36	3	6	41	95	2	5	-	-
VII	11	35	18	58	2	7	11	36	18	58	2	6	27	87	3	10	1	3
Total	75	54	55	40	7	5	72	53	58	42	7	5	127	93	7	5	4	2

Praying during the different moments of the day, at noon, in the afternoon, in the evening, represents a transfer, a shift of the official church routine into the private life of the individual: the morning service, Mass, evening service that are offcially performed at the same time in church ceremonials. Among the questioned subjects, 54% pray in the morning and at noon while 93% pray in the evening. The smaller percentage of subjects who pray in the morning is most probably influenced by the daily routine, limited time for many activities.The research emphasized that the percentage of students who pray in the morning is diminished with age, once the children become busier teenagers in high school, probably as a consequence of the same lack of time. The percentage of students who pray in the morning is 5% (47 subjects).

The afternoon prayer is a ‚thank you' prayer addressed to God, expressing gratitude for the food received. Over half of the students express their gratitude to God for the food as a result of family pressure and education, especially received from their grandparents. Almost all the subjects say their prayer in the evening (93%) and only 5% do not say it. The higher percentage of those who do pray in the evening before going to bed is a consequence of the fact that this period marks the end of daily activities, homework, individual relaxation, family and preparation for the much needed rest.

The percentage of the subjects who rarely pray during the various moments of the day is low (2%-5%) influenced by the lack of religious education in the family or by the ‚laissez-fairre' politics applied when it comes to religion, the lack of interest, conviction, etc.

Another important aspect of the informal religious ceremonial is the respect people have for their relatives, alive or dead, as one can see in the practice of cemetery rituals. In the Orthodox Christian faith the rituals represent the communion with the departed ones, as well as the psychological compensation for the loss. Among the interviewed subjects, 65% stated they went to the graves of their loved ones, with candles and flowers, honoring their memory. The percentage of these individuals was higher with age, once they turned to another superior class/age group and developed the awareness of the neccessity of honoring our forebears in the Religion classes. The percentage of subjects who do not go to the cemetery is only 4%, due to the fact that there is no one who died in the family.

It is essential for a good Christian to observe the religious customs, fasting, confession before the great Holy days such as Christmas and Easter, as all families educate their young from a very tender age (Table 4).

Table 4. The ritualistic dimension in the private space.

Class	Observe Fasting						Go to Confession						Have Holy incons at home				Pray before holy incons			
	Yes		No		Rarely		Yes		No		Sel-dom		Yes		No		Yes		No	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
IV	13	45	9	31	7	24	11	38	3	10	15	52	27	93	2	7	25	86	4	14
V	13	38	4	12	17	50	13	38	1	3	20	59	34	100	-	-	31	91	3	9
VI	25	58	9	21	9	21	25	58	2	5	16	37	41	95	2	5	37	86	6	14
VII	20	65	5	16	6	19	26	84	-	-	5	16	30	97	1	3	31	100	-	-
Total	71	52	27	19	39	29	75	55	6	5	56	40	132	96	5	4	124	90	13	10

From the data collected we can observe that over a half of the subjects fast (52%) and confess their sins to the priest (55%). In both situations there is an obvious tendency to observe these rituals over the years, as students grow older in high school. An evident growing up takes place that determines this behavior along with the Religion classes taught in school. At the same time, the individuals mature, they structure their religious convictions and start practicing them.

A significant manifestation of the religious fervour is the worship and prayer before the holy icons that symbolize a window to another spiritual dimension and, more importantly for a child, the visual representation of the entity to whom he/she prays.

According to Xenia Costaforu (2005), ”religious life may be seen beyond the religious feeling of any member of the group. We can see that even if there is no religious display from the group as a whole, such as collective prayer before lunch in the family or before going to work, the family may be in the habit of going to church together on certain ocassions, name days, Sunday Mass, they may have patron Saints that they worship in particular or even if they do not give away food for the dead there is still a religiosity to speak of. The number of holy icons placed in the house, the place where they are set, the Saints they display are a very significant proof of the faith of the studied group.”

For example: Toader Popa’s main house, number 118, houses an old holy icon from Catinca’s mother representing Jesus Christ the Redeemer and there is also a paper icon, stuck next to the votive light facing north, near the table where the icon is placed (Xenia Costaforu, 2005).

All the indicators found by Xenia Costaforu in her research study bring relevant information about the religious feelings of the individuals. Obviously, the holy icons and the designated spaces for them in a family home demonstrate the deep meaning that the faithfull Christians bestow on them, their faith and respect for religious customs in the private space.

Most of the subjects (96%) have holy icons in their homes, only 4% do not own such religious representations. Within this context, 124 subjects

pray in front of their holy icons, feeling a closer connection to the divinity that most of them perceive antropomorphically. The fact that between 3 to 6 subjects (10%), belonging to different classes, do not pray and worship God privately in front of the holy icons is probably due to the weak religious feelings and beliefs in the family or because they joined other religions or spiritual ways.

Based on the analysis of the informal ritualistic component, we can conclude that this is very well represented in the case of the sample researched group. The religious beliefs and feelings are strongly expressed through prayers during the different times of the day, more intense in the morning and in the evening, various rituals and customs at the relatives' graves in the cemeteries, as well as by observing fasting, conffesion and prayers in front of the holy icons.

According to Glock's theories (1962), the cognitive-intellectual dimension reffers to the area of knowledge, including, in the present research, the existence of religious books in the private space, watching different religious TV shows.

From the data gathered and presented in Table 5, 98% ffrom the sample subjects interviewed own religious books at home, while only 2 subjects (2%) do not have such books at home.

In most cases (88%), the religious books have been recently bought while the 12% of the test subjects already had such books.We did not find significant differences related to religious books and the students' ages.

Table 5. The intellectual dimension.

Class	No of Ss	Own religious books								Religious activities						Approach religious topics			
		Books already in the family				Bought recently				Watching radio TV shows						Yes		No	
		Yes		No		Yes		No		Yes		No		Rarely					
		no	%	no	%	no	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
IV	29	29	100	-	-	25	86	4	14	21	72	7	24	1	4	27	87	2	7
V	34	32	94	2	6	27	79	7	21	28	82	5	15	1	3	34	100	-	-
VI	43	31	72	-	-	29	93	2	7	12	39	13	42	6	19	22	71	9	29

Listening to religious radio shows and watching such TV shows is characteristic for 58% of the total students, the percentage decreasing with age, once the students are the growing up, while 49% of the students do not do this, an average of (36%) and 8 of the interviewed children (6%) seldom do so.

We can therefore conclude that over half of the interviewed children take part in such religious activities, while a third of them do not display such interests. Naturally, the decrease in the attendance to such religious

shows with age is associated with increased number of the subjects that do not display interest to such activities.

Approaching the religious topics, a result of family education and of the religious knowledge acquired in school during classs is a commmon feature to 88% of the sujects, with minor variations generated by the students' ages.

The intellectual dimension was well represented in the studied sample of children, most of the students previously owning religious books at home or buying them constantly, recently purchased books, watching religious TV shows, listening to radio shows and debating such related topcics.

The practical/experential dimension include faith in God, some feelings and thoughts related to the Divine power and its existence.

The information gathered in Table 6 presents the results of the interviews about the actual religious experience dimension and shows that almost all subjects, 134 students (98%) believe in God, only two 4th grade ones stated that they did not believe in God. Some religious experiences related to God's existence were found in 51 of the interviewed subjects (37%), 86 of them not having any such thoughts.

Table 6. The actual religious experience dimension.

Class	No. of students	Sex				Believe in God						Experiences related to God			
		Masculine		Feminine		Yes		No		Rarely		Yes		No	
		no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
IV	29	16	55	13	45	27	93	2	7	-	-	10	34	19	65
V	34	16	47	18	53	34	100	-	-	-	-	18	53	17	47
VI	43	21	49	22	51	42	97	-	-	1	3	15	35	28	66
VII	31	19	61	12	39	31	100	-	-	-	-	8	25	23	75
Total	137	72	52	65	48	134	98	2	1	1	1	51	37	86	63

In conclusion, the actual religious experience dimension is well outlined in this examined sample of children, overwhelming majority (98%) of students stating they believe in God. About one third (37%) of the students displayed certain religious feelings and thoughts.

The ideological or dogmatic dimension is more difficult to study and capture with these subjects, at such tender age, as their knowledge of theories is limited at this stage. Bearing this in mind, the present research study considers the ideological dimension only from the point of view of the information that the subjects have on the relics of Saints and the belief in the afterlife (Table 7).

Table 7. The ideological dimension.

Class	No. of Ss	Yes		No		In cities				In other cities		Yes		No		Rare-ly	
						Yes		No									
		no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
IV	29	27	93	2	7	7	25	22	76	1	3	17	60	8	27	4	13
V	34	34	100	-	-	3	8	31	92	1	2	19	57	12	35	3	8
VI	43	41	95	2	5	9	21	34	79	5	11	19	44	19	44	5	12
VII	31	31	100	-	-	3	10	28	90	4	13	10	33	15	48	6	19
Total	137	133	97	4	3	22	16	115	84	11	8	65	48	54	39	18	13

A number of 133 subjects (97%) among the students answered that they did have knowledge of the holy relics of Saints, while 4 children (3%) said they did not now anything about the topic.

Most of the subjects (115, respectively 84%) stated that in their city there are not holy relics of Saints, while 86% of the children stated that they did hear there are holy relics in other towns or cities.

Regarding the next question about believing in the afterlife, 48% of the subjects answered positively that they did believe in it, 39%-negatively, stating they did not share this view, while 13 students seldom had this experience.

The ideological dimesion studied in such young subjects is not well expressed as it is an area that is formed over the years when the individuals grow up and aware of religious truths and aquire a large quantity of religious information.

One last research is focussed on the religious rules/regulations or consequential/normative dimension, that includes the consequences of faith (Table 8).

Table 8. The religious regulations/normative dimension.

Class	No. of Students	Sex				Positively influences the behaviour of other people						Helps their parents					
		Masculine		Feminine		Yes		No		Selodm		Yes		No		Rarely	
		no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
IV	29	16	55	13	45	21	73	5	17	3	10	24	82	-	-	5	18
V	34	16	47	18	53	26	78	4	11	4	11	24	71	3	9	7	21
VI	42	21	49	22	51	29	67	8	19	6	14	29	68	1	2	13	30
VII	31	19	61	12	39	20	64	7	23	4	13	22	71	-	-	9	29
Total	137	72	52	65	48	96	70	24	18	17	12	99	72	4	3	34	25

This particular dimesion referrs to the positive effects of religion on the behavior of the individuals and the help the faithful provides to other people. This is a very significant fact that underlines the reality of the matter that the religious education received at home within the family and at school impacts the individuals in a positive way. A number of 96 subjects (76%)

stated that they agreed with this idea, the number slightly decreasing as the students got older.

Among interviewed subjects, 18% of them stated that they did not experience a change in their behavior, while 12% say that the positive influence of faith is very obvious.

The influence of faith on the children who do help their parents in the household is obvious in 72% of the subjects, a higher percentage being visible in younger children. A percentage of 25% of subjects help their parents rarely, which means that there is a lack in education.

4. Conclusions

The research performed on a homogeneous sample of children, 9-14 years old, highlited the existence of a strong faith, influenced by the combined actions of family and school, as a result of Religion teaching.

With only a few minor exceptions were found (two subjects), most of the students stated that they believed in God. Among the interviewed children, 91% go to church, mostly on Sundays.

The informal ritualistic segment was well expressed, over half of the interviewed subjects stating that they prayed to God in the morning, at noon, after the shared family lunch, especially more frequentely in the evenings after dinner (93%).

A significant practice of faith is emphasized in the private informal ritualistic dimension of religiosity, the percentage of subjects increasing with the age,children's maturity and growing awareness. More than half of the interviewed students fast, pray and go to confession on a regular basis, their number growing with age in high school.

The analysis of the intellectual dimension of religion highlights that there is a high percentage of families (98%) of the sample subjects researched that own religious books of prayers at home, buy them constantly, watch religious TV shows and events and listen to such radio shows.

According to the interviewed sample subjects, the religious education received in the family or at school has positively influenced their behaviour.

Based on the research and the evidence gathered, we can conclude that as far as children are concerned, the internalization of the religious customs, rites, practice is important in shaping their behaviour (and religious awareness) both for the present time and for their future evolution as adults.

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CERCETAREA CRIMINALISTICA A ELEMENTELOR DE SIGURANŢĂ A DOCUMENTELOR DE FRONTIERĂ ILICITE

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Rezumat
În lucrare se prezintă pe baza elementelor de siguranţă şi a procedeelor de realizare a documentelor actuale de călătorie cîteva cazuistici de falsificare întâlnite la treceriale de frontieră în ultimul timp. Se dau o serie de date privind investigarea lor ştiiţifică şi modul de evidenţiere a falsului în documente.

Keyword: falsul total, contrafacere, filigran, imprimare, imagine otpic-variabila, *imagine latentă*

1. Introducere

Activitatea de prevenire şi combatere a criminaliţăţii, necesită descoperirea urgentă şi completă a infracţiunilor, care constă în: identificarea infractorului, determinarea fără nici un dubiu a vinovăţiei în raport cu infracţiunes în cauză, aplicarea pedepsei prevăzute de legea penală şi recuperarea prejudiciului. În acest scop, organele de urmărire penală şi instanţele de judecată au dreptul şi în acelaşi timp obligaţia de a recurge la toate mijloacele permise prin care se poate stabili adevărul, situaţie valabilă şi în cazul judecării pricinilor civile [1-6].

Una dintre ramurile *ştiinţelor forensic* care s-a impus în vederea prevenirii şi combaterii fenomenelor infracţionale sau ilicite este *criminalistica*, care în raport cu *criminologia*, prima se referă la tehnica şi tactica aplicată la descoperirea acestora, pe când a doua are în atenţie urmărirea sau anchetarea crimei, urmată după finalizare de încadrarea ei juridică şi analiza efectului social al crimei, cu recuperarea prejudiciului dacă este cazul [7].

O ramura a *criminalisticii* este aceea legată de *gestionarea tactică şi juridică* a falsurilor în documente, care este întânlită încă din legea lui Lucius Cornelius SULLA FELIX (138 î.Hr.-78 î.Hr.), numită şi "Lex

Cornelia de falsis", fiind prima atestare a unor reguli de cercetare a falsurilor, care prevedea pedepse aspre pentru asemenea fapte ilicite [2, 5, 6].

În ultimul timp specialiştii criminalişti în fraudă documentară s-au confruntat cu o varietate de tipuri de falsuri existente în documentele de călătorie. Falsificatorii au utilizat diverse procedee, unele simple, având ca rezultat falsuri grosolane, sesizabile cu ochiul liber, dar pentru majoritatea s-au folosit tehnici perfecţionate, de natură să ducă în eroare chiar şi pe specialiştii cu experienţă. Documentele de călătorie falsificate sunt folosite cu precădere de traficanţii de carne vie, de grupările teroriste cu caracter transfrontalier, de infractorii periculoşi care se sustrag urmăririi penale sau care se sustrag de la efectuarea unei pedepse privative de libertate, precum şi de persoanele care provin din ţări sărace [8-11].

Pentru lucrătorii de frontieră şi cei ai miliţiei este foarte important să cunoască, în primul rând, toate elementele de siguranţă din documentele de evidenţă a populaţiei şi ele de trecere a frontierei şi apoi o serie de modificări posibile, în care au fost implicate tehnologii moderne de falsificare şi contrafacere. Cei mai avizaţi şi bine informaţi în acest domeniu sunt lucrătorii care lucrează la verificarea documente în prima linie de control la trecerea frontierei.

Pentru a reduce numărul celor care călătoresc cu documente false sau falsificate, UE prin Regulamentul 2252/2004 a impus cateva standarde pentru elementele de securitate şi elementele biometrice integrate în documentele de călătorie emise de statele membre[10]. Astfel s-a urmărit reducerea numărului celor care încearcă să folosească documente de călătorie false sau contrafăcute, respectând în acelaşi timp normele şi standardele tehnice internaţionale ISO (Organizaţia Internaţională de Standardizare) şi recomandările ICAO (Organizaţia Internaţională a Aviaţiei Civile).

În cele ce urmează sunt prezentate câteva elemente de siguranţă şi procedee de imprimare folosite la fabricarea documentelor de călătorie, modalităţi de falsificare şi respectiv de cercetare criminalistică a documentelor de călătorie clasice şi a celor electronice.

2. Partea Teoretică

2.1. Elemente de siguranţă folosite în cercetare

Un element de siguranţă important îl reprezintă *filigranul*. Acesta este realizat în procesul de fabricare a hârtiei cu ajutorul cilindrilor filigranari şi poate fi filigran fără umbră şi relief (negativ), filigran masă plată care este umbrit, dar nu prezintă nici un relief (pozitiv), filigran formă

rotundă care este umbrit şi prezintă reliefuri nepercepute la atingere (combinat) şi filigran electro-type. Filigranul electro-type este mai nou introdus in documentele de călătorie, acesta fiind format din cifre sau litere pe porţiuni mici şi este realizat prin electroliză.

Alte elemente de siguranţă care trebuie urmărite la examinarea documentului de călătorie le reprezintă imaginea latentă, imaginea retro-reflectivă, imaginea optic-variabilă, imaginea ascunsă, impresiunile fluorescente, chinegramele, hologramele, firul de siguranţă, fibrele, planşetele şi imaginea codată (IPI).

Imaginea latentă este o imagine care poate fi descifrată clar, numai dacă este privită dintr-un anumit unghi. Imaginea retro-reflectivă este o imagine vizibilă numai cu ajutorul unei lampe cu lumină coaxială, tip 3M, care utilizează un fascicol focalizat de lumină, iar cea optic-variabilă îşi schimbă culoarea dacă este privită din diferite unghiuri de vedere, datorită folosirii de cerneală iridizant-metalizată. Planşetele sunt presărate în mod aleatoriu pe traseul încă umed al hârtiei nefinisate, acestea putând fi iridiscente, vizibile în lumină albă sau în lumină cu raze ultraviolete. Fibrele sunt presărate în mod aleatoriu pe traseul încă umed al hârtiei nefinisate, fiind vizibile în lumină albă, cu reacţie în raze ultraviolete, vizibile numai în lumină albă sau invizibile în lumină albă, dar cu reacţie chimică sub razele ultraviolete.

Imaginea codată (IPI) este o imagine realizată prin intermediul unor mijloace softwer specializate. Aceasta cuprinde informaţii individuale despre numărul documentului, numele titularului, data naşterii care sunt integrate în fotografia acestuia sau informaţii statice cum ar fi numele ţării, integrate în desenul de fond al documentului. Informaţiile sunt invizibile cu ochiul liber, deoarece sunt ascunse şi nu pot fi văzute decât cu o lamelă specială sau cu un echipament de laborator (schener sau aparat de fotografiat cu calculator echipat cu softwer de procesare a imaginii). Imaginea optic variabilă (OVI), este realizată cu ajutorul unor cerneluri care conţin pigmenţi variabili din punct de vedere optic care prezintă modificări importante de culoare (variaţii puternice de culoare) în funcţie de unghiul de observare sau de iluminare. Cernelurile utilizate la realizarea imaginilor optic variabile sunt compuse din micro-fulgi dispuşi pe mai multe straturi într-un mediu de cerneală transparentă. Fulgii de pigment sunt elemente optice microscopice care selecţionează banda de frecvenţă (filtre de interferenţă).

2.2. Procedee de realizare a documentelor de călătorie

Tipărirea de fond este un desen de regulă geometric, imprimat pe filă, fin şi vizibil, formând un fond pentru textul ce urmează a fi imprimat. Aceasta se realizeaza de regulă cu un tipar offset. Tiparirea simultană reprezintă un desen imprimat în acelaşi fel, atât pe recto-ul, cât şi pe verso-ul filei. În momentul privirii filei prin transparenţă, toate elementele desenului coincid (se suprapun perfect). Tipărirea intaglio este o tipărire de pe o formă gravată, unde imaginea, mai precis cerneala, se află în partea superioară a proeminenţelor gravurii, imaginea putând fi sesizabilă tactil. La tipărirea tip curcubeu culorile se întrepatrund neexistând o linie clară de delimitare a acestora. Tipărirea tip guilloche, este imprimarea fină a unei imagini decorative formată prin imtercalarea unor linii curbe.

Metodele de imprimare ale documentelor de călătorie, recomandate prin Regulamentul UE, sunt gravarea laser, perforarea laser, imprimarea cu jet de cerneală (inkjet) şi cea laser, metoda prin termotransfer şi termosublimare, imprimarea offset, precum şi metode folosind tehnica fotografică.

Gravarea laser este o metodă relativ recentă care se utilizează la documentele de călătorie mai noi realizate din policarbomat (ex: fila informatizată de la paşapoarte, premise de şedere, permise de conducere, carţi de identitate, etc.). Folosind această metodă se pot imprima datele de identitate ale unei persoane, fotografia acesteia, seria şi numărul documentelor.

Perforarea laser se foloseşte, de regulă, pentru realizarea fotografiei în umbră din documentele de călătorie şi a seriei documentelor de călătorie. Perforarea mecanică este realizată prin efectuara de găuri în mod mecanic (prin străpungere sau ştanţare) în scopul de a încorpora un număr sau un motiv într-un document. Numerele de la seria documentului sunt perforate conform unui aranjament regulat, de tip matriţă, de găuri circulare de mărime egală, străpunse întotdeauna în aceeaşi direcţie. Perforarea mecanică se recunoaşte prin marginile ridicate („bavuri") care pot fi simţite pe spatele suportului. Termotransferul se realizează cu ajutorul unei foiţe cerate, pe care sunt imprimate fotografia şi datele de identitate, utilizând culorile de bază (cyan magenda galben şi negru - CMYK), iar termosublimarea se realizează cu ajutorul unei foiţe cerate,însă imaginile sunt imprimate cu ajutorul unui dispozitiv cu ace încălzite, care dispersează cerneala. Imprimarea offset se realizează printr-un procedeu de imprimare indirect în care textul sau imaginea sunt transferate pe un cilindru acoperit cu o suprafaţă de cauciuc şi de acolo sunt imprimate pe suport. Imprimarea offset se bazează pe principiul respingerii reciproce dintre apă şi grăsime, se

caracterizează prin distribuţia uniformă a cernelii şi margini cu limite precise. Zona de imprimare şi cea care nu imprimă se află pe acelaşi plan al plăcii de imprimare [].

La documentele de călătorie electronice se folosesc aceleaşi tehnici de imprimare şi elemente de siguranţă, numai ca acestea mai au în plus faţă de celelalte documente, amprentele digitalizate ale persoanei, fotografia digitalizată a persoanei încorporate în cip.

2.3. Sisteme de falsificare şi cercetare criminalistică a falsurilor în documentele de călătorie

2.3.1. Falsul parţial şi total

Falsul parţial, cunoscut şi sub numele de contrafacere, constă în înlocuirea unei porţiuni din documentul de călătorie, în aşa fel încât, efectele juridice ale documentului de călătorie să fie cu totul altele decât cele pentru care a fost constituit iniţial.

Falsurile cu agenţi chimici se descoperă şi se cercetează cu ajutorul razelor ultraviolete precum şi a unor compuşi chimici speciali. De asemenea în momentul intervenţiei mecanice sau chimice asupra documentului se distrug şi elementele de siguranţă, desenul de fond fiind şters, filigranul distrus.

În momentul în care un document de călătorie este suspect de falsificare expertul criminalist examinează documentul de călătorie cu ajutorul unor tehnici din laborator pentru a se stabili modul de falsificare (înlăturarea de text, cifre sau litere, acoperirea de text, modificarea, adăugirea şi imtercalarea de text, decuparea şi reconstituirea unor file sau înlocuirea fotografiei, contrafacerea parţială a documentului etc.).

Înlăturarea de text, cifre sau litere este utilizată de obicei la nume şi prenume şi la semnele particulare. Acoperirea de text se realizează prin acoperirea unei porţiuni din text. Aceasta este în general o manoperă grosolană, sesizabilă cu ochiul liber. Modificarea, adăugirea şi intercalarea de text, se realizează prin modificarea unor litere şi cifre sau prin intercalarea unor texte în locurile rămase libere. Prin această metodă se falsifică numele, prenumele, data naşterii, data eliberării şi valabilitatea documentului. Decuparea şi reconstituirea unor file constă în detaşarea unei porţiuni dintr-un document autentic şi lipirea acesteia la un alt document. De regulă, se detaşează porţiuni cu datele de identitate sau cu diferite vize şi acestea se transpun la documentul nou constituit de la care s-a detaşat, de asemenea, o porţiune de formă celei ce urmează a fi introduse. Înlocuirea fotografiei se face pentru a se putea folosi documentul de către o altă persoană decât titularul. O metodă relativ nouă de falsificare, dar care s-a

extins foarte mult în ultima periodă este ace3ia a inlocuirii filei cu datele de identificare ale titularului. Astfel, sunt detaşate din paşaportul original fila ce cuprinde datele de identitate ale titularului şi corespondenţa acesteia, cu alte file din acelaş tip de document sau falsificate prin tehnici de imprimare.

Falsul total constă în contrafacerea în totalitate a unui document. Acesta poate fi realizat de persoane particulare sau diferite organizaţii cu preocupări de natură ilicită. În prezent, în astfel de acţiuni ilicite, se folosesc tehnici dintre cele mai avansate. Astfel, având la dispoziţie aparatură de vârf (maşini speciale de tipărit, copiator color, etc) se reuşeşte contrafacerea mai multor tipuri de documente, unele cu elemente de siguranţă complexe, greu de reprodus. Prin implicarea tehnicilor complementare, multifuncţionale, de copiere şi redare, se pot realiza elemente de siguranţă integrate foarte aproapiate de cele din documentele originale, ceea ce îngreunează foarte mult descoperirea lor.

La documentele de călătorie se poate observa în momentul examinării criminalistice o imprimare neconformă. Dimensiunile literelor şi cifrelor sunt mai mari, filigranul lipseşte sau este diferit faţă de cel original. De asemenea, dimensiunile documentului pot fi altele decât cele ale celui original, lipsind planşetele, fibrele, modul de broşare fiind diferit, iar tipul de hârtie folosit la confecţionarea filelor documentului poate fi şi el diferit.

2.3.2. Metode şi tehnici de cercetare

Falsul parţial se poate realiza folosindu-se mijloace mecanice sau chimice. Falsificarea mecanică se cercetează şi se descoperă cu ajutorul aparatelor optice de mărit (lupa, stereolupă, microscop, stereo-microscop, epidiascop, comparator video-spectral), folosindu-se lumina perpendiculară sau laterală sub diferite grade de înclinare.

2. 4. Documentele valabile procurate în alb pe căi ilicite

Acestea sunt cel mai greu de desconspirat deoarece ele sunt autentice şi îndeplinesc condiţiile de formă şi fond. Aceste documente sunt cumpărate imediat după fabricare de la producător pe cai ilicite, apoi sunt completate de către persoane neautorizate. În momentul în care exista suspiciuni la un astfel de document de călătorie se verifică de catre expertul criminalist tehnica de imprimare a datelor titularului. Se măsoară dimensiunea literelor şi cifrelor, se compară tehnica de imprimare a datelor cu tehnica folosită într-un document completat de autorităţile competente. De asemenea se efectuează un control amănunţit asupra persoanei şi a bagajelor acesteia pentru a se vedea dacă nu are asupra ei şi alte documente cu identitatea reală.

Modul de falsificare sau contrafacere precum şi modul de cercetare criminalistică a documentelor de călătorie electronice este similar celorlalte documente, numai ca acestea mai au în plus cipul cu unde radio (RFID). Acesta conţine datele biometrice ale persoanei, care pot fi citite cu ajutorul unui cititor de cip-uri de la distanţe mici. O particularitate a acestor cip-uri este faptul ca nu poate fi rescris, ci doar clonat. Însă pentru a se împiedica clonarea acestora s-a introdus un cod de securitate în aceste cip-uri. În momentul introducerii acestora în document ele sunt asigurate cu o folie de protecţie.

În ciuda introducerii acestor elemente de siguranţă, s-a demonstrat că acest cip poate fi clonat foarte uşor şi fără costuri prea mari. Pentru a se realiza acest lucru este nevoie doar de un calculator cu un program special şi un cititor de carduri, acestea putând fi citite la o distantă de până la 30 m. Datele clonate în calculator pot fi transmise pe alt cip, sau modificate pe calculator şi apoi transmise pe un alt cip. Acesta poate fi folosit într-un document de călătorie fals sau într-un document de călătorie procurat în alb pe căi ilicite şi completat de către persoane neautorizate. Această metodă de falsificare este greu de depistat deoarece cipurile clonate sunt citite de cititoare, clonarea putând fi demonstrată după o examinare criminalistică specială de către experţii criminalişti în IT. De asemenea poate fi distrus prin prăjire (într-un cuptor cu microunde) sau prin îndoirea zonei unde se află cip-ul până se rupe antena acestuia, rămanând în urmă policarbonatul crăpat sau deteriorat. Aceste metode sunt relativ uşor de identificat deoarece aceste cipuri nu mai pot fi citite.

3. Partea experimentală

3.1. Materiale şi metode

După 1990 la trecerile de frontieră ale României au fost indentificate un număr mare de documente de călătorie, dintre care amintim: paşapoarte, cărţi de identitate, vize, cărţi de înmatriculare, cecuri şi valută, timbre poştale, certificate şi titluri de valoare şi a altor titluri de valoare emise de către state, carţi de credit şi mijloace de plată, procuri şi alte documente notariale.

Dintre acestea, în lucrarea de faţă sunt luate în discuţie o serie de documente greu de identificat la prima vedere, sub forma falsului total şi parţial, respectiv o viză (Fig. 1a) şi un paşaport simplu (Fig.). În identificarea acestora s-a folosit comparatorul video-spectral şi stereo-microscopul

3.2. Rezultate şi discuţii

Prin utilizarea luminii infraroşii s-a localizat ştergerea mecanică dintr-o viză identificată iniţial prin mijloacele specifice controlului de frontieră în lumină IR (Fig. 1a), care a fost ulterior examinată şi prin alte tehnici. Astfel, o serie de caracteristici de suprafaţă privind ştergerea mecanică s-a obţinut prin folosirea luminii albe, când s-a observat că desenul de fond este deteriorat în locul în care s-a intervenit mecanic, microtextul este distrus, iar hârtia este scămoşată în zona respectivă (Fig. 1b). Întrucât, cele două tehnici au permis indetificarea corectă, viza falsă nu a mai necesitat şi alte analize, cum ar fi cea cu raze UV, stereomicroscopia sau microscopia electronică de baleaj cu spectrometrie de raze X.

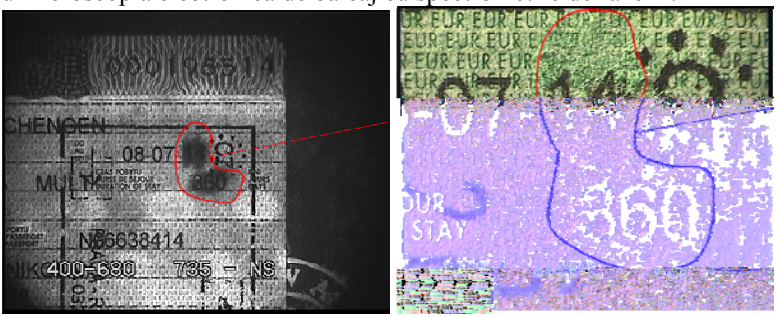

Fig. 1. Evidenţierea zonelor cu ştergere mecanică în lumină infraroşie (a) şi albă (b)

Cel de al doilea caz de contrafacere parţială este un paşaport simplu , la care s-a inlocuit fila cu datele de identificare ale titularului, respectiv fila informatizată (Fig. 2b). In documentul examinat, in momentul privirii in lumina alba s-a observat diferenţe mari între un document autentic (Fig.2a) pentru ţara respectivă (Bulgaria) folosit ca model de comprat şi cel contrafăcut, desenul de fond este diferit, lipseau kinegramele transparente de pe folia TKO (Fig. 2b).

Fig. 2. Fila informatizată în lumină albă a documentului autentic şi cel contrafăcut

Un element esenţial care a sugerat ca este o contrafacere a fost fotografia, care deşi a fost imprimate laser color, faţă de referinţă (Fig. 3a) raster-ul este diferit (Fig. 3b). În cazul fotografiei autentice punctele sunt aliniate pe verticala şi orizontală, iar la cea contrafăcută punctele sunt aliniate oblic.

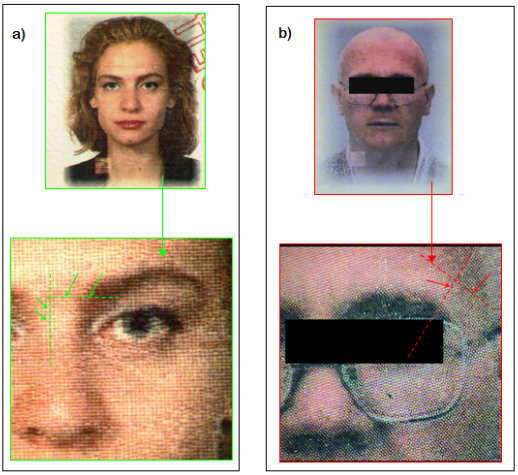

Fig. 3. Imaginea marită a unei porţiuni dintr-un document autentic (a) şi contrafăcut (b) evidenţiind alinierea diferită a raster-ului

La analiza documentului în lumina UV s-a identificat şi alte elemente care au sugerat că este vorba de o contrafacere. Cu ajutorul luminii UV s-a evidenţiat lipsa fibrelor galben verzui în documentul contrafăcut şi deteriorarea grupului de litere BGR (Bulgaria) din jurul fotografiei în umbră (Fig. 4b).

a.

b.

Fig. 4. Imaginea în lumină U.V. a documentului original (a) şi cel contrafăcut (b)

Un caz de fals total este ilustrat în figura 5, în care se evidenţiează diferite tipuri de contrafacere, care pot fi văzute fie în lumină albă sau UV, fie în IR. Un prim element care sugerează că respectivul document este un fals a fost lipsa *imaginii optic variabile* la iniţialele RF, care asigura fotografia documentului (Fig. 5b), aceasta nu şi-a schimbat culoarea în momentul privirii din diferite unghiuri. De asemenea, la documentul contrafăcut lipseşte *imaginea latentă* (Fig. 5d). Desenul care ar trebui sa conţină imaginea latentă este realizat *offset*, spre deosebire de imaginea autentică care este realizată *intaglio*. În momentul privirii în lumină albă, sub un anumit unghi, in cazul documentului autentic (Fig. 5c), se observă cuvântul "FRANCE", care lipseşte la cel fals

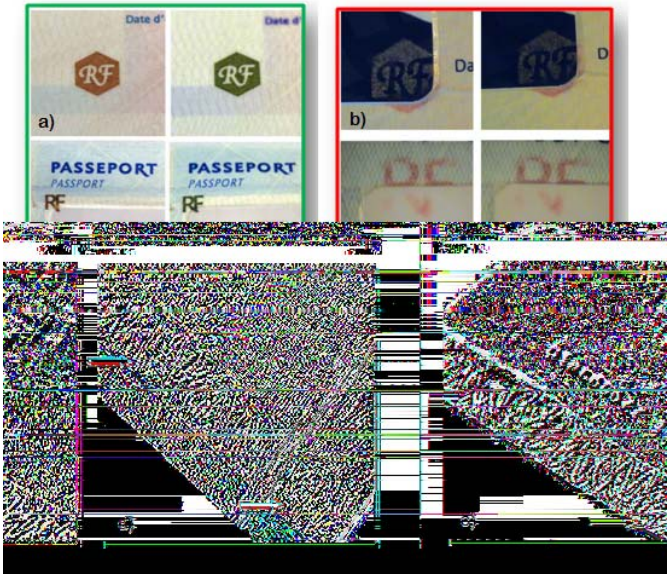

Fig. 5. Imaginea unui document autentic (a, c) şi contrafăcut (b, d) analizat sub lumină albă

Folosind lumina transparentă s-a identificat şi alte elemente care au sugerat falsul. Astfel, la documentul contrafăcut (Fig. 6b) lipseşte filigranul şi firul de siguranţă, în timp ce la documentul autentic (Fig. 6a) se poate observa filigranul combinat cu imaginea une femei, filigranul electrotype şi firul de siguranţă cu microtext negativ.

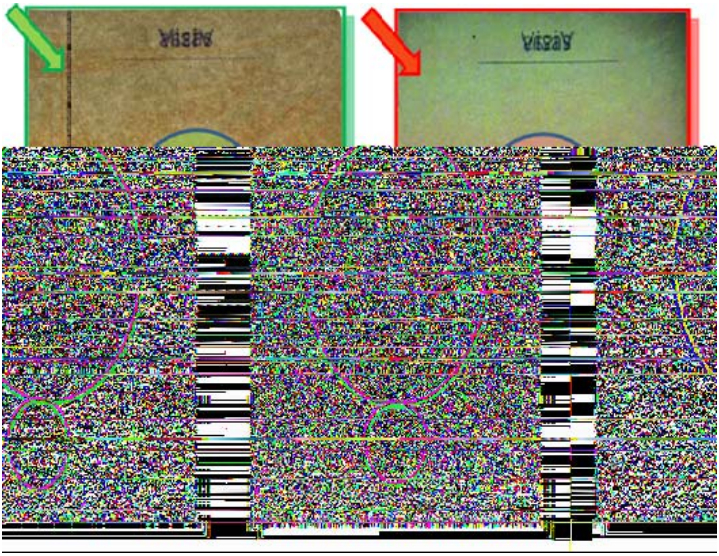

Fig. 6. Imaginea unui document autentic (a) şi
contrafăcut (b) în momentul privirii în lumină transparentă

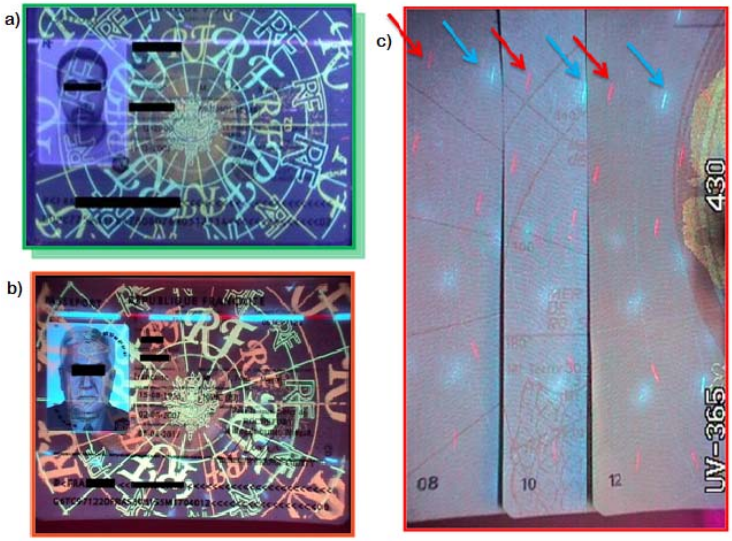

Fig. 7. Documentul falsificat are reacţie diferită în lumina UV

În momentul expunerii în lumină UV, fila informatizată din documentul fals are reacţii diferite. Fila informatizată a documentului autentic reacţionează galben-verzui (Fig. 7a), pe când cea contrafăcută reactionează galben-verzui şi roşu (Fig. 7b). De asemenea, s-a constatat că există diferenţe şi în cazul aşezării fibrelor din filele paşaportului contrafăcut (Fig. 7c). Acestea sunt asezate în aceiaşi poziţie pe fiecare pagină şi nu în mod aleatoriu cum este normal.

Un element important al contrafacerii documentului este modul de perforare seriei acestuia. La documentul autentic (Fig. 8a) perforarea este laser, observându-se urme ale arderii în jurul marginilor găurilor, descreşterea marimiii găurilor, în timp ce la cel contrafăcut (Fig. 8b) seria este realizată prin perforare mecanică, găurile având aceeaşi dimensine, iar marginile găurilor sunt ridicate pe verso.

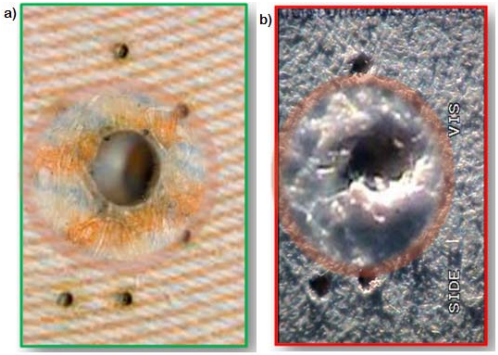

Fig. 8. Perforarea seriei unui document autentic (a) şi contrafăcut (b)

4. Concluzii

În prezent, riscurile şi ameninţările cu care se confruntă un stat au din ce în ce mai mult un caracter transfrontalier şi pot fi ţinute sub control numai printr-o cooperare activă a tuturor statelor şi prin utilizarea unor metode şi tehnici moderne de investigare, cât mai precise. Falsificarea şi contrafacerea documentelor de călătorie sunt infracţiuni grave care aparţin, în cele mai multe cazuri, unor reţele transfrontaliere de crimă organizată.

Documentele sunt înscrisuri de o însemnatate deosebită, de aceea cercetarea criminalistică a lor este foarte importantă, dar şi complexă în acelaşi timp, deoarece infractorii dispun de mijloace tehnologice actuale de reproducere sau contrafacere. Din acest punct de vedere, experţii criminaliştii din toate ţările au nevoie de dotări informaţionale şi mijloace

moderne de investigare a documentelor falsificate sau contrafăcute. Datele tehnice şi ştiinţifice necesită o înnoire sistematică, deoarece metodele şi procedeele de falsificare se schimbă continuu, aparând noi posibilităţi de modificare în fals a documentelor.

Lucrarea permite, în baza prezentării principalelor procedee de falsificare prin implicarea tehnologiilor actuale de imprimare, redare sau modificare cu scop ilicit, să evidenţieze o serie de alemente care au fost falsificate sau contrafăcute la două grupe de documente de trecerea frontierei: viza şi respectiv două paşapoarte.

La viză, indentificată ca fiind falsă iniţial prin analiză în lumină IR şi ulterior a fost examinată şi prin alte tehnici, care a permis prin folosirea luminii albe evidenţierea ştergerii mecanice, când s-a observat că desenul de fond este deteriorat în locul în care s-a intervenit mecanic, microtextul este distrus, iar hârtia este scămoşată în zona respectiv . Întrucât, cele două tehnici au permis indetificarea corectă a vizei false nu a mai necesitat şi alte analize.

Cel de al doilea caz de contrafacere parţială este un paşaport simplu, la care s-a inlocuit fila cu datele de identificare, care in momentul privirii in lumina alba s-a observat că există diferenţe mari faţă de documentul autentic,desenul de fond este diferit, lipseau kinegramele transparente de pe folia TKO. Un element esenţial care a sugerat ca este o contrafacere a fost fotografia, care deşi a fost imprimată laser color, faţă de referinţă raster-ul este diferit. În cazul fotografiei autentice punctele sunt aliniate pe verticala şi orizontală, iar la cea contrafăcută punctele sunt aliniate oblic. La analiza în lumina UV s-a identificat şi alte elemente care au sugerat că este vorba de o contrafacere şi anume s-a evidenţiat lipsa fibrelor galben verzui în documentul contrafăcut şi deteriorarea grupului de litere BGR (Bulgaria) din jurul fotografiei în umbră.

În cazul de fals total s-a evidenţiat diferite tipuri de contrafacere, care pot fi văzute fie în lumină albă sau UV, fie în IR. Un prim element a fost lipsa *imaginii optic variabile* la iniţialele RF, care asigura fotografia documentului, aceasta nu şi-a schimbat culoarea în momentul privirii din diferite unghiuri, de asemenea, la acest document lipseşte *imaginea latentă*. Desenul care ar trebui sa conţină imaginea latentă este realizat *offset*, spre deosebire de imaginea autentică care este realizată *intaglio*. La documentul contrafăcut lipseşte filigranul şi firul de siguranţă, în timp ce la documentul autentic se poate observa filigranul combinat cu imaginea une femei, filigranul electro-type şi firul de siguranţă cu microtext negativ. Fila informatizată a documentului autentic reacţionează galben-verzui, pe când cea contrafăcută reactionează galben-verzui şi roşu. De asemenea, s-a constatat că există diferenţe şi în cazul aşezării fibrelor din filele

paşaportului contrafăcut, acestea sunt asezate în aceiaşi poziţie pe fiecare pagină şi nu în mod aleatoriu cum este normal. Un element important al contrafacerii ultimului document analizat este modul de perforare seriei acestuia. La cel autentic perforarea este laser, observându-se urme ale arderii în jurul marginilor găurilor, descreşterea marimiii găurilor, în timp ce la cel contrafăcut seria este realizată prin perforare mecanică, găurile având aceeaşi dimensine, iar marginile găurilor sunt ridicate pe verso.

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