TREATISE
OF
NON-CONVENTIONAL TECHNOLOGIES

The today equipment and, I believe, the near future one, is characterised by high reliability at running in stressful conditions (shocks, high pressure, very high and very low temperatures), no matter if they are cars, lathe machines, rackets, energetic plants, armaments, etc.

Exactly these extreme conditions lead to the necessity to use new materials and to "invent" new technologies, so called "non-conventional", for which the material machining process is not anymore conventional - for example the mechanic force application through the cutting tool in turning – but an alternative one, by using focused energies under different types, like electrical discharge machining, laser beam machining, electron beam machining, ultrasonically machining, etc.

Between these two main technological groups of dimensional machining there is an obvious dialectical relationship. Conventional – non-conventional demarcation limit is under a continuous movement because of permanent move of non-conventional field to the one of established technologies (conventional), according to the recorded scientific and technological progress. In the same time, the non-conventional machining technologies area is continuously feeding with new possibilities which are now placed in the nearly or distant future field. Obviously, the non-conventional area may become interesting for practical applications only if the non-conventional may eliminate conventional through qualitative and quantitative superior results, through new simple and direct creative solutions, or through positive energetically implications.

The most eloquent example for the above says is dimensional machining through electrical discharge machining. If only by nowadays the dimensional machining through electrical discharge machining was the representative process of non-conventional technologies, today this passed the "uncertainties" area by becoming an objective necessity for any dimensional machining technological process. This process can now be considered a well-based process in the technological process area which can be efficiently applied to metallic materials machining, but there can be found and foreseen more and more application fields.

World-wide, these new technologies started to be applied in the time of World War II and especially after that, so far almost 60 years.

Nowadays, in the world-wide industry the non-conventional dimensional machining technologies percentage is almost 15 – 20 % from all applied technologies. In Romania, this percentage is only 2-3 %.

To keep the step with civilised world, it is necessary to accord the technology field by aligning to the developed countries. This is the reason ROMANIAN ASSOCIATION FOR NON-CONVENTIONAL TECHNOLOGIES (ARTN) is working for strong implementation of non-conventional technologies in Romanian economy.

The application of alternative technologies normally supposes a strong analyse of all the involved elements, a comparative advantages and disadvantages itemisation, a verification of processes framing in the main trend of evolution. For all these it is necessary a detailed knowledge of practical and technological “intimates” of the processes.

The traditionally framed dimensional machining processes in the field of conventional one, the above mentioned can be considered a prior known through the actual Romanian third level structure and through obvious “discrimination” of non-conventional technologies in industrial application of Romanian economy. In exchange, the information about non-conventional dimensional machining processes is presenting a limited contents area. For informational "balancing" of the two technological groups it’s considered to be necessary publishing an exhaustive monograph regarding the new and little known processes of dimensional machining. This is one of the main reasons for which Romanian Association for Non-conventional Technologies is trying to publish “TREATISE OF NON-CONVENTIONAL TECHNOLOGIES”.

ARTN is considering that editing this exhaustive bibliographic work is one of the main ways to help Romanian economy and one of the effective contributing ways of this professional association to technological impulsion of Romania.

In the same time the publishing of TREATISE OF NON-CONVENTIONAL TECHNOLOGIES is contributing to skill and perfect the specialists for these new technologies of materials processing.

To openly approach all these aspects that rule the non-conventional machining processes the treatise was conceived as being composed of 11 books, each one of them containing one machining process from this field.

The titles of these books are or will be the following:

Book I – Non-conventional technologies at the start of millennium;

Book II – Electrical discharge machining;

Book III – Electrical erosion through contact breaking machining;

Book IV – Electrochemical machining;

Book V – Complex electrical - electrochemical machining;

Book VI – Electron beam machining;

Book VII – Laser beam machining;

Book VIII – Ultrasonically machining;

Book IX – Plasma erosion machining;

Book X – Machining through erosion with kinetic activated fluids;

Book XI –Non-conventional materials machining;

For the future it is intended to complete this treatise with new books containing other non-conventional acceptable technologies (or alternative), like non-conventional technology of welding, treatment, plastic deformation, smelting, etc.

The predicted structure of the books is the normal one for presenting the dimensional machining processes. The structure composes theoretical analyses, technical systems presentations for process application, many technological information, but also economical aspects for optimisation and future thoughts.

The treatise books will be elaborated by Romanian specialists which presented their PhD thesis in the respective book area and which poses a great practical and scientific experience in that field.

The treatise is addressed first of all to the specialists which are working in the dimensional machining of materials area, to mechanical engineers, electrochemical engineers, electronic engineers, automatic engineers, but also to the technicians which are working in these fields. The treatise is becoming a great importance bibliographic support for all the technical third level students from the mechanical, electromechanical, automatic and electronic areas.

To the present were published four books from the 11 or more predicted books of the treatise.

Book I – “Non-conventional technologies at the start of millennium” was published in 2003, it is containing the general knowledge of non-conventional technologies and it is extended to 552 pages.

After defining the non-conventional technologies, information from the history of non-conventional technologies, world-wide, as well as from Romania, are presented.

The history of Romanian non-conventional technologies is strongly emphasised. After a classification of non-conventional technologies, there are shortly presented the physical fundamental phenomenon, the technological principles for erosion machining, for all the known and today applied processes. It is about electrical discharge machining, chemical machining, electrochemical machining, complex electrical - electrochemical machining, photon (laser) and electron beam machining, ultrasonically machining, plasma erosion machining and machining through erosion with kinetic activated media.

Due to the fact that non-conventional materials are used more and more at the beginning of this new millennium, this book dedicates an entire chapter to their structure, properties and specific machining procedures of these materials.

As in any other manufacturing, we are especially interested in the quantity, quality and the cost of the product, this book and the other 10 books (or many) have also a chapter regarding optimisation of the presented technologies. There are also presented economical aspects of the non-conventional technologies use. It is not omitted the problem of the non-conventional technologies management.

Looking forward the book includes remarks on the non-conventional technologies perspectives for the near and distant future.

The book II – "Electrical discharge machining" has been published in 2004 and has an extension of 602 pages, being structured in four parts.

Part I – "Phenomenological aspects in electrical discharge machining" is deploying in two different directions, which complete each other. There are presented a multitude of theories regarding the physical mechanism of material removing in electrical discharge machining, theories that are partially or completely included in the theory generally accepted today for elementary process in electrical discharge machining and new theories that can develop a new, revolutionary vision of this concept. On the other hand is presented the thermoelectric theory of material removing, accepted today as a phenomenological base of electrical discharge machining.

Part II –"The technological system of electrical discharge machining" is divided in two different parts that presents the technological system of electrical discharge machining with massive tool electrode (copying the shape of the electrode) and the technological system destined to the electrical discharge machining with wire tool electrode. There are analysed all the components of the technological systems for electrical discharge machining, being emphasised the most efficient solutions and constructive ideas.

In part III "Electrical discharge machining technologies" are synthesised the main technological machining aspects of homogenous metallic materials (especially steels) and non-homogenous metallic materials (sintered hard alloy, cermets, polycrystal of diamond), through massive tool electrode electrical machining and, also, wire tool electrode electrical discharge machining.

The last part, the forth, is destined to the presentation of the management, control and forecast of electrical discharge machining.

The book V – "Complex electrical - electrochemical machining" has been published in 2004 and has an extension of 312 pages, being structured in six chapters.

In chapter 1 – "Dimensional machining through complex erosion" are presented the elementary main processes in dimensional machining through complex erosion (anode dissolution and impulse electrical discharge) and is also analysed the heat exchange in the process, this analyse being strongly to the energetically components of the working space.

The parameters, the factors and the technological characteristics of machining are detailed in chapter two. There are reviewed the economical precision characteristics, the surface micro-geometric characteristics, the productivity characteristics and the transfer wear characteristics. Then are presented: the state parameters, the mechanical and electrical influence factors, the factors determined by the work piece, the transfer object, the working liquid, the technical system, the machining type and the operator. The chapter ends with an application of the systemic conception the evaluation of the complex erosion machining process.

Chapter 3 is dedicated to the technological machinery and the complex erosion machining operation. Each specific system is detailed after the presentation of the general structure of the machining equipment. There are emphasised a lot of typical constructive solutions.

The stages and methodologies of machining technology design through complex erosion, contains aspects included in chapter 4.

In chapter 5 is approached the optimisation of the complex erosion machining, and in the chapter 6 are presented the optimisation possibilities using the computer.

The book VIII – "Machining through erosion using ultrasonic waves" has been published in 2004 and has an extension of 522 pages, being structured in nine chapters.

The main approach problems of this book are the following:

- Characteristic phenomena for generation and propagation of ultrasonic waves;
- Technological systems for production and concentration of ultrasonic energy;
- Ultrasonic motors;
- Phenomenological and technological applications;
- Ultrasonic control and fault detection;
- Green technologies and imagistic, etc.

The treatise has a strong scientific base, including pertinent and valuable information many of them being absolute novelty, but also with concrete and practical orientation, able to complete the necessary information for any specialist who works in this area and bring new supporters to this process.

By the end of 2005, we estimate to finish the book VI, X and XI and during 2006 and 2007 we estimate to finish the non-approached books or other necessary books required by the time coming.

I would like to thank to all the actual and future co-authors and colleagues for the quality and quantity of their work. I also thank to all the one who have contributed indirectly to the publishing of this treatise with additional contributions to its high scientific level.

My gratitude goes directly to the Ministry of Education and Research for the understanding and support given, especially financial.

Through their greatness and informational density the books of the treatise are above any other works regarding non-conventional technologies published in Romania or in the world.

It can be considered that the "TREATISE OF NON-CONVENTIONAL TECHNOLOGIES" will become the main pillar for the theoretical sustain of this novel method of dimensional machining of materials. Therefore, I consider that the Romanian Associations for Non-conventional Technologies has successfully accomplished its mission, by giving to the interested ones an exciting, vast and valuable theoretical and practical documentary.

Now, it's the time for the economical industrial system to act quickly and efficiently in order to align the Romanian industry, in this area, to the advanced industries of the world.

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