

# **FACULTY OF ENGINEERING IN HUNEDOARA**



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## RESEARCH CENTER OPTIMIZATIONS IN THE INDUSTRY OF MATERIALS

### GENERAL PRESENTATION

The Research Center “Optimizations in the Industry of Materials” is recognized by the National Board of Higher Education Scientific Research through certificate No. 100/CC-C of 11.05.2001. It is established at the Faculty of Engineering in Hunedoara and it includes staff involved in the research activity in the fields of electrotechnics, mechanics and metallurgy.

The Electrotechnics Department has specialized laboratories for researches on the functioning of the rotative electric equipment and transformers, electrical equipment, electric and electronic circuits, for carrying out the achievement and processing of data, the analysis of the quality of the electric power of different consumers, studying the electromagnetic compatibility, the analysis and synthesis of the automatic adjustment of the parameters of the industrial processes, using the classic adjustment methods, as well as new methods, based on the fuzzy logic, neuronal networks, expert systems.

In the laboratories of the Metallurgy Department, the teaching staff can carry out researches in the fields of chemistry, plastic deformation, studies related to the elaboration of iron and non-ferrous materials, thermal treatments and economic researches (prognosis, diagnosis etc.).

The material resources and infrastructure of the Mechanics Department ensures the possibility of carrying out mechanic tests at the surrounding temperature and low temperatures, the research of the behavior of some machinery parts (belts, bearings, springs etc.) during functioning and the tribologic analysis of lubricants and various pairs of materials.

### MISSION

The Research Center “Optimizations in the Industry of Materials” offers the framework for scientific research and human resources formation activities in the fields of electrotechnics, mechanics and metallurgy.

The research activity carried out within the research center is strictly related with the teaching process and aims at:

- solving research topics in the field of materials
- forming specialists who may contribute, through their qualification and performances, to the enlargement of the state of knowledge

- raising the competitiveness of the Faculty of Engineering in Hunedoara on the qualifications market requested by the market economy
- forming of elites within the young generation
- obtaining outside the budget incomes for the modernization of the laboratory infrastructure.

### FIELDS OF RESEARCH

Numerical modeling and control of the induction heating electro technology. Electromagnetic compatibility. Modeling and simulation of electro thermal installations. Modeling, simulation and automation of processes in the sintering plants by Fuzzy logic. Magnetism, physics of systems of magnetic nano-particles, magneto – insulator materials, methods and models of simulation. Adaptive processing of signals. Improvement of power factor in electric installations with automatic controllers. Improvement of performances for some industrial electric filters. Accomplishment of analogical and numerical protections for low voltage three-phase induction motors. Analysis of electric parameters, from the point of view of electro-magnetic compatibility, for different consumers: dust electric filters, lighting systems, and electric motors. Implementation of programming automatic machines and micro-controllers in applications. New design and diagnosis methods for electric installations. Design and accomplishment of some new electronic devices for protection of low voltage electric motors. Design and accomplishment of some new switch apparatus with integrated logical circuits. Design and accomplishment of data computers (switch boards) for different types of electric actuations in wire and programmed structure. Implementation of programming automatic machines in industrial applications. Research on modeling and management of metal continuous casting process. Research on electric power quality in the electric railway transport. Principles, methods and technologies for standardization of object oriented software systems. Artificial Intelligence. Distributed Software. Multi-agent Systems. Distributed Constraints’ Software. Research on systems based on virtual reality and educational software applications. Resistance of materials. Elasticity. Plasticity. Processing technologies. Tests on materials at high temperatures. Thermal fatigue of hot rolling cylinders. Optimization of resistance structures. Analysis of tensions and deformations. Processing in semi-solid status of metallic alloys. Reliability and maintainability of industrial entities.

Theory of linear operators' semi-groups. Study of spectral properties, convergence properties and some representation formulae both for semi-groups of series  $C_0$  and integrated ones. Research on fluid motions with sliding phenomena on plane surfaces in the first-order approximation. Processing of experimental data by mathematic modeling with truncate probability laws. Theory of operators, study of stability and dichotomy of a solution of differential equations. Machines and hydro-pneumatic actuations. Rolling of materials. Research development for continuous casting products. Waste recycling. Environmental protection.

#### KEYWORDS

Induction heating; numerical modeling; numerical control; electromagnetic compatibility, indicators of electric power quality, harmonic regime, continuous casting, crystallizer (mould), Fuzzy governing, expert system; electric installations, electronic relays, electric filters, protections, electromagnetic compatibility, programming automatic machines, protections, switch apparatus, data computers (switch boards), magnetism, nano-particles' systems, virtual reality, educational software, agents, constraints, messages and induction searching techniques, mechanical characteristics, high temperatures, fatigue, tensions, durability, optimization, cylinders,  $C_0$ -semi-groups, integrated semi-groups, adjunct semi-groups, diffusion operators, Schrödinger operators,  $L^\infty$ - uniqueness, fluids, sliding phenomena, truncate probability densities, theory of semi-groups, operators in Banach spaces, machines and actuations, hydraulics, pneumatics, mechanics of fluids, steel, waste, environmental, casting, ingot.

#### ACTIVITIES

- Numerical modeling (using the Finite Differences' Method -MDF and Finite Elements' Method - MEF) of electromagnetic and thermal fields of materials heated by electromagnetic induction;
- Analysis of electromagnetic interference produced by operating the induction hearth furnaces which are supplied at industrial frequency;
- Research on the main energy quality indicators;
- Analysis of the electric power quality;
- Accomplishing a filtering system for the main harmonic of voltage and current;
- Conceiving an automatic system of current harmonic filtering;
- Study on principles and methods of harmonic regime compensation;
- Conceiving the structure of a hierarchic system meant to lead the continuous casting process;
- Conceiving the structure of an expert system based on Fuzzy logic meant to control the level of steel in the crystallizer (mould) and secondary cooling;
- Setting up the governing algorithms based on experimental measurements and conceived mathematic model;
- Design of Fuzzy algorithms that are necessary to calculate the command figures used by governing algorithms;
- Drawing up the rules' basis and their technological analysis using a mathematical model.
- Assimilating in the fabrication process of new technologies of carbon and alloyed steel making;
- Improving the technologies of carbon and alloyed steel making and casting in the direction of improving the physical – mechanical and technological characteristics;
- Reducing the electric power and thermal energy consumption, auxiliary and raw materials, refractories and metal specific consumption;
- Introducing in the iron and steel industry economic circuit of some metal waste with iron content resulted from different industrial branches (iron and steel industry, energetic industry, mining industry, mechanical engineering industry, chemical industry, etc.);

#### RESEARCH PROJECTS

1. Grant A 2005 (continuing in 2006): *Complex relay to protect the contact line against abnormal operational conditions* – code CNCSIS 623 nr. 27688/14.03.2005. Director: Assoc. prof. dr. eng. Caius Pănoiu. Value: RON 12,500.
2. Grant AT 2006: *Research and experiments on thermal and equivalent tensions in hot rolling cylinders in order to increase the resistance at thermal fatigue and service life* - code CNCSIS 45, Subject 3, No. 58 GR /19.05.2006. Director: Assoc. prof. dr. eng. Camelia Pinca-Bretotean. Value: RON 27,000.
3. Contract 3194/13.10.2005 (continuing in 2006): *The optimization of the thermal regime of the steel on the direction furnace – secondary treatment unit – continuous casting installation* - Program CEEEX for Young Researchers Director: Lect. dr. eng. Erika Ardelean. Value: RON 6,100.
4. Contract 232/20.07.2006: *New refractories of complex functions used in steel industry, made by modern technologies*, Program CEEEX Consortium – Partner P2. Responsible: Prof. dr. eng. Teodor Hepuț. Total value of the contract RON 1.800.000 (Partner P2- RON 100,000).
5. Contract 233/20.07.2006: *Integrated technology to obtain some non-conventional energy* –

technological sources, used as raw materials for steel making, Program CEEEX Consortium – Partner P3. Responsible: Prof. dr. eng. Teodor Heput. Total value of the contract RON 1,900,000 RON (Partner P3- RON 100,000).

6. Contract 5889/18.09.2006: *Research on quality insurance for rolling mill cylinders by mathematic modeling of the manufacturing process and experimental study on durability in exploitation*, Program CEEEX for Young Researchers. Director: Lect. dr. Eng. Imre Kiss. Value: RON 110,000.
7. Contract 3196/13.10.2005 (continuing in 2006): *Researches and experiments regarding the improvement of semi manufactured good structure continuous casting*, Program CEEEX for Young Researchers. Director: Lect. dr. eng. Ana Socalici. Value: RON 75,000.

## PUBLICATIONS

### BOOKS

1. Pănoiu, C., Cristea, D., *Interfaces and peripheries – Laboratory Guide*, „Mirton” Publishing House of Timișoara, 2006, ISBN (10)973-52-0004-X, (13)978-973-52-0004-6, 92 pages (published in Romanian language).
  2. Cioată, V. G., *Industrial technical drawing*, „Mirton” Publishing House of Timișoara, 2006, ISBN 973-661-826-9, 200 pages. (published in Romanian language).
  3. Maksay, S., Stoica, D., *Mathematics assisted by computer*, „Politehnica” Publishing House, Timisoara, ISBN 973-625-298-1, 187 pages. (published in Romanian language).
  4. Maksay, S., *Chapters of Special Mathematics*, „Mirton” Publishing House, Timisoara, ISBN 973-661-515-4, 218 pages. (published in Romanian language).
  5. Kiss, I., *Quality of rolling mill cylinders cast from graphite nodule pig iron*, „Mirton” Publishing House, Timișoara, 2005, ISBN 973-661-763-7, 180 pages. (published in Romanian language).
  6. Kiss, I., *Technology of iron making and casting – in laboratory experiments*, „Mirton” Publishing House, Timișoara, 2006, ISBN 973-661-827-7, 102 pages. (published in Romanian language).
- ### PUBLISHED PAPERS
1. Osaci, M., i.e., *Numerical stochastic model for the magnetic relaxation time of the fine particle system with dipolar interactions*, Applied Mathematical Modeling 30, 2006, pp. 545-553
  2. Pănoiu, M., Pănoiu, C., Șora, I., *Experimental Research Concerning the Electromagnetic Pollution Generated by the 3-Phase Electric Arc Furnaces in the Electric Power Supply Networks*, Acta Electrotechnica ISSN 1241-3323, 2006, Volume 47, No. 2, pp. 102-112.
  3. Pănoiu, M, i.e., *An interactive learning environment for analyze linked list data structures*, International Journal of Computers, Communication & Control, Supplementary Issue – Proceedings of ICCCC 2006, Volume 1, pp. 350 – 359
  4. Pănoiu, M., *Simulating result for modeling the AC Electric Arc as nonlinear element using PSCAD EMTDC*, WSEAS Transaction on Circuits and Systems (in course of publication).
  5. Muscalagiu, I., *The Experimental Analysis of the Impact of the “No-good Processor” Technique on the Efficiency of the Asynchronous Techniques*, Proceedings of ICCCC2006, Băile Felix - Oradea, Romania, 2006, pp. 326-331
  6. Muscalagiu, I., Popa, H. E., Pănoiu, M., *Asynchronous Backtracking with temporary and fixed links: A New Hybrid Member in the ABT Family*, Journal of Computer Science INFOCOMP, Brazil, Vol. 5, nr 2, 2006, pp. 29-37
  7. Tirian, G.O., *High-speed neuronal estimator for the command of the induction machine*, International multidisciplinary scientific symposium”UNIVERSITARIA SIMPRO 2006” October 13-14, 2006, pp.62-65
  8. Deaconu, S., Popa, G., Popa, I., *Modern solutions to reduce the pollution caused by Electric Arc Furnaces*, Review of Automations and Instrumentation No.1/2006, ISSN 1582-3334, pp.10-12.
  9. Deaconu, S., *Welding system with ultrasonic of conductors for car wires*, The VI-th National Multi-curriculum Conference – with international attendance, „Professor Dorin Pavel – founder of the Romanian hydro-electric engineering”, Sebeș, 2006, ISBN 973-720-030-6, pp. 335-338.
  10. Deaconu, S., *Automation of rubber sleeves in the area of crossing the wires through the car body*, Review of Automations and Instrumentation No.3/2006 ISSN 1582-3334, pp.17-18.
  11. Deaconu, S., Popa, G., Popa, I., *Wind power station with induction generator and static frequency converter*, Scientific Works of the International Multi-curriculum Symposium „Universitatea SIMPRO” 2006, Petroșani, 13-14 October 2006, ISSN 1842-4449, pp.31-33.
  12. Dascăl, A., i.e., *Numerical research on the optimization of the chemical composition for OLT 35K steel with a view to obtaining superior mechanical features at high temperature*, Metallurgic International, No.1/2006, ISSN1582-2214, pp.28-33.
  13. Dascăl, A., Maksay, Ș., *On the Optimization of the chemical structure for OLT 45K Steel in*

- Views of Obtaining Superior Mechanical Characteristics at High Temperatures*, 10<sup>th</sup> International Research/Expert Conference „Trends in the Development of Machinery and Associated Technology” TMT 2006, Floret de Mar, Spain, 2006, pp.261-264
14. Dascăl, A., *Experimental testing for the determination the hardness test by hot, for heat-resistance steel*, 10<sup>th</sup> International Research/Expert Conference „Trends in the Development of Machinery and Associated Technology” TMT 2006 Floret de Mar, Spain, 2006, pp. 257-260
  15. Dascăl, A., *Research on the influence of high temperatures on the tenacity of 12MoCr90 steel*, 10<sup>th</sup> International Research/Expert Conference „Trends in The Development of Machinery and Associated Technology” TMT 2006 Floret de Mar, Spain, 2006, pp.1271-1274
  16. Pinca-Bretotean, C., Tirian G. O., *Research and experiments regarding the thermal and the equivalent tension from the hot rolling mill cylinders, in avoiding the growing thermal fatigue resistance and the increase of service life*, 10<sup>th</sup> International Research/Expert Conference “Trends in the Development of Machinery and Associated Technology” TMT 2006, Barcelona, Spain, 11-15 September, 2006, pp.1419-1422
  17. Pinca-Bretotean, C., Tirian G. O., Socalici A.V., *The study of thermal regime of the hot rolling mill cylinders*, 10<sup>th</sup> International Research/Expert Conference “ Trends in the Development of Machinery and Associated Technology TMT 2006, Barcelona, Spain, 11-15 September, 2006, pp.1327-1330
  18. Pinca-Bretotean, C., *The research experimental equipments on the thermal tension of the hot rolling mill cylinders*, National Conference of Metallurgy and Materials Science, Bucharest, Romania, ROMAT 2006, 28-29 September, pp.289-295
  19. Pinca-Bretotean, C., Tirian G. O., *The numerical analysis of the asymmetrical thermal tension from hot rolling mill cylinders*, National Conference of Metallurgy and Materials Science, Bucharest, Romania, ROMAT 2006, 28-29 September, pp.296-303
  20. Pinca-Bretotean, C., *The evolution of the thermal and equivalent tension of the hot rolling mill cylinder*, Scientific Works of the International Multi-curriculum Symposium “UNIVERSITARIA SIMPRO 2006”, Section of Machines and technological equipment, Petroșani 13-14 October 2006, pp.75-80
  21. Cioată, V. G., i.e., *Possibilities of controlling the qualitative characteristics of the die-forging parts of semisolid materials*, International Industrial Conference “Machines, Technologies, Materials – Innovations for the Industry” Proceedings, ISBN 954-9322-15-7, 27 March 2006, Sofia, Bulgaria, pp. 59-62.
  22. Cioată, V. G., i.e., *Possibilities of controlling the qualitative characteristics of the die-forging parts of semisolid materials*, in Machine building and Electrotechnics 12/2005, ISSN 0025-455X, Bulgaria, pp. 27-31.
  23. Cioată, V. G., i.e., *A new method of processing in the semisolid state of the metallic alloys. Experimental researches regarding the technological parameters*, The 4th Symposium with International Participation KOD 2006 - Proceedings, ISBN 86-85211-921, 30-31 May 2006, Palic, Serbia & Montenegro, pp. 267-270.
  24. Lemle, L.D., Jiang, Y. *Strongly continuous semi groups generated by a non-densely defined operator*, Scientific Works of the International Multi-curriculum Symposium „Universitaria Simpro 2006”, Petroșani, 2006, pp.15-18
  25. Lemle, L.D., Jiang, Y. *Uniqueness of weak solutions for some heat diffusion operators*, Proceedings of the Eleventh Symposium of Mathematics and its Applications
  26. Maksay, S, Stoica, D., *Considerations on modeling some distribution laws*, Applied Mathematics and Computation, 175 (2006), pp. 238-246
  27. Maksay, Ș., Stoica, D., *Burr distribution modeling truncated*, Annals of the Faculty of Engineering Hunedoara, 2006, Tome IV, fasc. 2, (ISSN 1584-2665), pp. 55-60.
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  29. Maksay Ș., Stoica D., *Study of the non-dimensional solution of dynamic equation of movement on the plane plaque with consideration of two-order sliding phenomenon*, Annals of the Faculty of Engineering-Hunedoara, 2006, Tome IV, Fasc. 2, (ISSN 1584-2665), pp. 87-92.
  30. Maksay, Ș., Stoica, D., *Distribution truncate  $\chi^2$  modeling with three parameters*, Annals of the Faculty of Engineering-Hunedoara, 2006, Tome IV, Fasc. 1, (ISSN 1584-2665), pp. 165-170.
  31. Maksay, Ș., Stoica, D., *Considerations in physical surface about a fluid motion in boundary layer with sliding phenomena*, Annals of the Faculty of Engineering-Hunedoara, 2006, Tome IV, Fasc. 1, (ISSN 1584-2665), pp. 171-176.
  32. Maksay, Ș., Stoica, D., *Considerations about a motion on type Hamel white consideration phenomena of sliding on cylinders*, A VI-a The National Multi-curriculum Conference – with international attendance, „Prof. D. Pavel” Sebes, 2006, pp. 275-278

33. VasIU, T., Budiul Berghian, A., *Survey on reduction gear forecasting availability*, Annals of the Faculty of Engineering Hunedoara 2006, Tome IV, Fasc. 1, (ISSN 1584-2665), pp.141-148.
34. VasIU, T., Budiul Berghian, A., *Experimental essays and interpretation of results of the cast iron – allied steel friction coupling at relatively high temperatures and speeds*, Annals of the Faculty of Engineering Hunedoara 2006, Tome IV, fascicle 1, (ISSN 1584-2665), pp. 129-132.
35. Budiul Berghian, A., VasIU, T., *Kinetics study on mechanisms of parallel gang shears' type assigned for cutting metallurgical products*, Annals of the Faculty of Engineering Hunedoara 2006, Tome IV, Fasc. 1, (ISSN 1584-2665), pp. 125-128.
36. Alexa V., Nussbaum, A. I., *Theoretical and economical consideration about parametrical forces of asymmetrical rolling*, Annals of the Faculty of Engineering Hunedoara, 2006, Fasc. 1, (ISSN 1584-2665), pp. 7-11.
37. Ardelean, E., i.e., *Technological parameters interaction over quality on continuous cast semi-finished product*, Industrial Practical Conference „Machines, Technologies, Materials 06”, 24-28 March 2006, Sofia, Bulgaria, pp.113-116
38. Ardelean, E., Ardelean, M., Hepuț, T., *Study of technological parameters at continuous casting billet with 180mm section*, Section 3: „Machines Engineering Technologies”, Annals of the Oradea University, Fascicle of Management and Technological Engineering, Vol.V (XV), 2006, ISSN 1583-0691, pp. 67-70.
39. E. Ardelean, *Study regarding the steel temperature adjustment possibilities at continuous casting*, 10<sup>th</sup> International Research / Expert Conference „Trends in the Development of Machinery and Associated Technology” TMT 2006, 11-15 September 2006, Barcelona – Lloret de Mar, Spain. – presented and published in the volume of the session, pp. 165-168
40. Ardelean, E., i.e., *The technological parameters optimizing to continuous cast of semi-finished steel products of 150mm, in order to reduction faults appearance*, 10<sup>th</sup> International Research / Expert Conference „Trends in the Development of Machinery and Associated Technology” TMT 2006, 11-15 September 2006, Barcelona – Lloret de Mar, Spain. – presented and published in the volume of the session, pp. 181-184
41. E. Ardelean, T. Hepuț, M. Ardelean, *Research concerning the obtaining from industrial wastes a cover powder used in steel continuous casting*, the 4<sup>th</sup> International Conference on Materials and Manufacturing Technologies (MATEHN 06), 21'23 September 2006, Cluj Napoca, România – presented and published in the „Book of abstracts”, pp.214-217
42. E. Ardelean, T. Hepuț, M. Ardelean, A. Socalici, *Industrial experiments regarding using of some wastes as covering powders in continuous casting tundish*, “National Conference of Metallurgy and Materials Science”, 28-29 September 2006, Bucharest, pp. 430-434
43. Kiss I., Maksay S., *Mathematical interpretation of dependence of the semi hard cast rolls hardness's on main alloy elements*, “Masinstvo” – Journal Of Mechanical Engineering, No.2 / 2006, Zenica, Bosnia & Herzegovina, pp. 19-20
44. Kiss I., Ripoșan, I., *Research on the durability in exploitation of the hot rolling mill cylinders*, Annals of the Faculty of Engineering Hunedoara, 2006, Tome IV, Fasc. 1, pp. 47-56
45. Kiss I., Alexa V., Ratiu S., *The quality improvement of the hot rolling mill cylinders in some mathematical interpretations*, The 4<sup>th</sup> Symposium About Shaping, Industrial And Product Design - KOD 2006 Palić, Serbia & Montenegro, pp . 277-280
46. Kiss I., Maksay, S., *Mathematic modeling of manufacturing process for casting rolling mill cylinders*, The National Conference with international attendance „Science and Engineering”, Volume. X, Sebeș Alba, 2006, pp. 215-222
47. Kiss I., Maksay, S., *Mathematical models adapted for the area of the iron cast cylinders*, Annals of the Faculty of Engineering Hunedoara, 2006, Tome IV, Fasc. 2, pp. 71-76
48. Kiss I., Maksay, St., *The hardness of the cast iron cylinders in some mathematical interpretations*, Annals of the Faculty of Engineering Hunedoara, 2006, Tome IV, Fasc. 2, pp. 77-82
49. Kiss I., Ripoșan, I., *The durability in exploitation of the hot rolling mill cylinders – in laboratory experiments*, Annals of the Faculty of Engineering Hunedoara, 2006, Tome IV, Fasc. 2, pp. 179-186
50. Socalici, A., *Respects regarding the usage micro-cooler to casting steel*, „10<sup>th</sup> International Research Expert Conference „Trends in the Development of Machinery and Associated Technology TMT 2006”, 11-15 September 2006, Barcelona-Lloret de Mar, Spain, pp. 157-158
51. Socalici, A., i.e., *Settlement possibilities of steel temperature in crystallize*, 10<sup>th</sup> International Research Expert Conference „Trends in the Development of Machinery and Associated Technology TMT 2006”, 11-15 September 2006, Barcelona-Lloret de Mar, Spain, pp. 161-164
52. Socalici, A. Hepuț, T., *Simulation of the continuous cast blank solidification using micro-coolers in crystallizer*, „4<sup>th</sup> International Conference on Materials and Manufacturing

- Technologies MATEHN'06", Cluj- Napoca, România, 21-23 September, 2006, pp. 203-206
53. Socalici, A., i.e., *Possibility improvement of quality continuous casting steel product*, „National Conference of Metallurgy and Materials Science”, 28-29 September, Bucharest, 2006, pp. 333-334
54. Socalici, A., i.e., *The conduct of solidification for the steel ingots using the micro-coolers*, The Journal Masinstvo Nr.1-2, 2006 Zenica, Bosnia and Herzegovina, pp. 3-14
55. Socalici, A., Abrudean, C., Hepuț, T., *Simulation of continuous cast semi-finished steel products with uniform addition of micro coolers in the crystallizer*, Session of scientific communications „IMT ORADEA” 2006, pp. 15-18

#### PERSPECTIVES, INTERESTS, STRATEGIC PRIORITIES

- Development of some mathematical models 2D and 3D based on MDF, and of some simulating programs able to allow numerical control of induction heating for parts with complex shape;
- Design of a numerical control system for heating in volume/ superficial hardening of steel parts
- Making compatible the induction heating installations that are supplied at industrial frequency;
- Conceiving a controller in real time and a software according to the intelligent command of a complex system of conveying belt in a sintering plant;
- Analysis of electric parameters, from the point of view of electro-magnetic compatibility, for different consumers;
- Utilization of purchasing plates, development plates with micro-controller and some automatic programming machines to measure and govern some industrial processes;
- Theoretical and experimental study on electric filters with industrial plates
- Accomplishment of new sizing methods for electric installations with different configurations;
- Accomplishment of new electronic protections used for low voltage electric motors;
- Utilization of programming automatic machines to govern some industrial processes;
- Research on wind power plants;
- Implementation of a virtual information science system assigned for study and interactive training in the field of data structures and software modern techniques;
- Improvement and expansion of NetLogo models used for implementation of induction techniques. It is about expansion of these NetLogo models in order to allow the multi-variable frame, management of messages and simultaneous processing of all messages from the message tails. Also the aim is to introduce the new problems regarding to induction techniques, i.e. the so called „binary random problems”, which permit a more accuracy study of the behavior of induction techniques, the problem of graphs coloring being a particular case;
- Identification of other solutions of improvement of induction techniques' performance. A first idea in this respect is related to the study of redundant messages, in the direction of identification the causes that generate them and finding other solutions of their reduction or elimination, but before to be transmitted to the agents. The second idea is related to the study of techniques in situation of existence of dynamic orders on agents. The third subject of study (relative to performances' improvement) refers to the trying to expand the ABT family for the situation when the agents operate with many variables.
- Implementation of the three-dimensional model of simulation of relaxation processes in the magnetic nano-particle systems as system of shared calculus.
- Study of sliding phenomena on plane surfaces in the second-order approximation and truncate probability densities.
- Study of exponential dichotomy of differential equations in Banach spaces.
- Reduction of the pollution degree in iron and steel industry.
- Improvement of carbon steel and alloyed steel making technologies.
- New technologies of making and processing the metal alloys with special destination

#### RESEARCH TEAMS

1. **Numerical modeling and control of the induction heating electro-technology**
  - Lect. dr. eng. Angela Iagăr
  - Assoc. prof. dr. eng. Caius Pănoiu
  - Assoc. prof. dr. eng. Nicolae Rusu
  - Assoc. prof. dr. eng. Sorin Deaconu
  - Assist. eng. Cristian Abrudean
2. **Artificial Intelligence. Shared software. Multi-agent Systems. Distributed Constraints' Software (DCSP- Distributed Constraint Satisfaction Problem).**
  - Lect. eng. Ionel Muscalagiu
  - Prof. dr. eng. Jose Vidal
  - Assoc. prof. dr. eng. Manuela Pănoiu
  - Prof. dr. eng. Horia Emil Popa
  - Stud. Mihai Balan
3. **Improvement of performances of electric filters with industrial plates**
  - Assoc. prof. dr. eng. Iosif Popa



- Assoc.prof.dr.eng. Sorin Deaconu
  - Lect. Dr.eng. Corina Diniş
  - Lect. Dr.eng. Angela Iagăr
  - Assist. eng. Cristian Abrudean
  - Assist. eng. Ovidiu Tirian
- 4. Physics of magnetic nano-particles dispersion systems – simulation methods and models**
- Assoc.prof.dr.eng. Mihaela Osaci,
  - Lect. eng. Ionel Muscalagiu,
  - Assoc.prof.dr.eng Manuela Panoiu,
  - Assist. eng. Anca Iordan
- 5. Research on implementation of systems based on virtual reality and educational software applications**
- Assoc.prof.dr.eng. Manuela Pănoiu
  - Assoc.prof.dr.eng. Caius Pănoiu
  - Lect. eng. Ionel Muscalagiu
  - Assoc.prof.dr.eng. Mihaela Osaci
  - Assist. eng. Anca Iordan
  - Lect. eng. Adela Berdie
  - Assist. eng. Sorina Şerban
- 6. Thermal fatigue of rolling mill cylinders. Durability of rolling mill cylinders**
- Assoc.prof.dr.eng. Camelia Pinca - Bretotean
  - Assist. eng. Ovidiu Tirian
  - Lect.dr.eng. Imre Kiss
  - Assist. eng. Adina Budiul – Berghian
- 7. Processing in semi-solid status of metallic alloys**
- Lect. dr. eng. George Vasile Cioată
  - Lect. dr. eng. Vasile Alexa
  - Assist. dr. eng. Imre Kiss
  - Assist. Daniela Stoica
- 8. Sliding phenomena on plane surfaces**
- Prof. dr. Ştefan Maksay
  - Assist. Dan Lemle
  - Assist. Diana Stoica
  - Assist. Diana Bistriian
- 9. Study of truncate probability densities**
- Prof. dr. Ştefan Maksay
  - Assist. Dan Lemle
  - Assist. Diana Stoica
  - Assist. Diana Bistriian
- 10. Optimization of the thermal regime of steel on the direction of furnace – secondary treatment unit – continuous casting installation**
- Lect. dr. eng. Erika Ardelean
  - Lect. dr. eng. Ana Socalici
  - Lect. dr. eng. Marius Ardelean
- Lect. Dr.eng. Corina Cunţan
  - Assist. eng. Erika Popa
  - Assist. eng. Cristian Abrudean
- 11. Refractories with complex functions used in the steel industry, made by modern technologies**
- Prof.dr.eng. Teodor Hepuţ
  - Lect. dr. eng. Erika Ardelean
  - Lect. dr. eng. Ana Socalici
  - Lect. dr. eng. Marius Ardelean
  - Lect. dr. eng. Laura Benea
  - Lect. Dr.eng. Ana Josan
  - Prof.dr. Ştefan Maksay
  - Assist. Adrian Bleoca
- 12. Integrated technology used to obtain some non-conventional energy technological sources, used as raw materials for steel making**
- Prof.dr.eng. Teodor Hepuţ
  - Lect. dr. eng. Erika Ardelean
  - Lect. dr. eng. Ana Socalici
  - Lect. dr. eng. Marius Ardelean
  - Lect. dr. eng. Caius Pănoiu
  - Asist.dr.eng. Adrian Găvănescu
  - Lect. dr. eng. Mihaela Osaci
  - Lect. dr. eng. Vasile Puţan
- 13. Processing in semi-solid status of metallic alloys**
- Lect. dr. eng. George Vasile Cioată
  - Lect. dr. eng. Vasile Alexa
  - Lect. dr. eng. Sorin Raţiu
- 14. Assimilating, making, casting of iron, steel and non-ferrous alloys**
- Lect. dr. eng. Virginia Socalici
  - Lect. dr. eng. Erika Ardelean
  - Lect. dr. eng. Marius Ardelean
  - Lect.dr.eng. Camelia Pinca-Bretotean
  - Assist. eng. Erika Popa
- 15. Increasing the life span of metallurgical equipment**
- Assoc.prof.dr.eng. Teodor Vasii
  - Assist. Diana Stoica
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