

INTEGRATIVE MECHATRONICS - NATIONAL PLATFORM FOR INTERDISCIPLINARY EDUCATION AND RESEARCH TRAINING

Gh. Ion Gheorghe – INCDMTM BUCHAREST

Abstract: *The work discusses both at the national and the international level, the scientific and technologic evolution from precision mechanics engineering to intelligent and information micro-engineering, by presenting engineering evolution matrixes, the structural and the functional generations of High-Tech integrated products, technologies and concepts that make use of advanced research areas and of the development in competitive knowledge.*

Keywords: *integrating mechatronics engineering; intelligent and informational microengineering; integrative engineering;*

1. INTRODUCTION

«Integrative Mechatronics» includes essentially a systemic and synergetic vision in synthesizing a new conception of fundamental knowledge and scientific discoveries, built in micro-nano-engineering solutions, globally applicable in micro-nano-manufacturing, micro-nano-products and micro-nano-technologies in industry and laboratories.

«Integrative Mechatronics» develop a new integrative conception of global systems approaches, systems of individual products and complete system of products designed components, subsystems and parts, ensuring priorities innovative, useful and effective solutions and high quality.

«Integrative Mechatronics» apply evolutionary creation of new generations of products systems for industry, research and education and for advanced high-tech areas. «Integrative Mechatronics» will contribute in a fundamental way through knowledge and intelligence to the development of nanosciences and nano-engineering for new high-tech industry, for the new globalized economy and the new Information Society.

In this expression «Integrative Mechatronics» place, through the structure, content and logic, the array of technical and scientific learning, experimentation, demonstration, assimilation and expression, different levels of knowledge in multidisciplinary integrated system of education and scientific research.

"Europeans" education has always been one step ahead "Romanians" education, approaching "disciplinary activities, culture, civilization and moralization of man, to form individual for himself, developing them into a lot of interest" (Herbert).

In this context, scientific work "Integrative Mechatronics - National Platform for Interdisciplinary Research in Vocational Education and Training, provides support for the development of new educational technologies, developing new lines of social scientific research and development of mission critical to the future information society.

Currently, all world countries have large and increasing budgets allocated to education, research and innovation through programs from national platforms and Education Training Research.

2. NATIONAL PLATFORM STRUCTURE «INTEGRATIVE MECHATRONICS»

Thus, the platform «Integrative Mechatronics» is nationally applied on levels and categories of knowledge, education and research:

- (a) at education level
- (b) at university level
- (c) at postgraduate level
- (d) from academic level.

Each level includes an appropriate structure of "Integrative Mechatronics" platform with well-defined syllabus and technical expressed assimilation of theoretical knowledge, practical and innovative.

Evolving, especially selected for each level set, platform "Integrative Mechatronics", shall include express, compared with the competitive and / levels / European / international, as follows:

a) for education level

- mechatronics **science** / foundations, applications / trends, etc.
- interdisciplinary fields components / precision mechanics, electrical, electronics, IT;
- scientific **principles and concepts** of component fields of science mechatronics, multidisciplinary nature of mechatronics;
- microsystems used in mechatronics / MS /;
- highly measurement microsystems;
- microsystems technology / TMS /;
- measuring quantities receptors / sensors / transducers / actuators, etc./;
- robotics and applications / foundations, principles, concepts, etc./;
- microtechnology in mechatronics;
- mechatronics products / microdevices, intelligent equipment, intelligent instruments, etc.

b) for university level

- technologic mechatronics, mechatronic product and system, mechatronics and process of manufacture, hardware and software mechatronics;
- Information microprocessing in mechatronics / processors, controllers, intelligent control systems, software; etc./;
- systems and computer equipment for measuring, adjusting and controlling in-process and post-production process;
- mechatronics, micromechatronics and nanomechatronics; robotics, microrobotics and nanorobotics, for different fields;
- methods, mathematical programming and related functions and processes governing industrial processes and measurement, control and inspection, integrated intelligent control automated manufacturing processes; integronics, microintegronics and nanointegronics; mechatronic laboratory /
- mechatronic center (research, design, testing, demonstration, comparison, performance models, technology, etc);

c) for postgraduate level

- integrating mechatronic concept [intelligent instrumentation and information, sensors / transducers / devices / equipment, systems / microsystems, robots / microrobots, etc.]; machines / micromachines in 3D, 4D and 5D, cells / smart centers, modeling by CAD / CAM;
- advanced research programs and design / CATIA, SolidWorks, INVENTOR, MATHLAB, MATHCAD, COSMOS, etc.. / automated manufacturing systems and computer;
- intelligent manufacturing and automation / flexible manufacturing, equipment / machinery / cell / flexible systems, etc. /;
- new generation for CAD / CAM / computer aided manufacturing, CIM concept, control systems; etc. /;
- modeling and simulation of computer-aided manufacturing, manufacturing systems organization;
- hydronic and pneumatic / control units, positioning, control, modular systems, robotic stations, distributors, amplifiers, programming environments, different applications, etc. /; digitronic Systems / fundamental logic circuits: memory circuits, counters, registers, industrial automation applications, etc. / Audio-visual techniques and systems, micro and nanofabrication; etc.

d) for academic level

- nanosciences and nanoengineerings in Mechatronics;

- sensors / actuators Multiparameter sensors and nanomaterials and nanostructures, micro and nanoelectronics;
- micro and nanofabrication developed for “surface and table”; integronic and integrative micro-nano-engineering;
- nanoprocessing and processing systems microengineering with nanometric and subnanometrical precisions;
- nano-measurement systems microengineering with subnanometrical resolution and accuracy; nanopositioning systems microengineering with nanometric precision and fidelity;

➤ **nanotechnologies in Mechatronics:**

- nanorecticular systems technology;
- nanolithography technology with subnanometric accuracy / photolithography; electronolithography; ionolithography; synchrotron lithography with x-rays etc;
- nanofforming technology / with photons fascicle or laser; with electrons fascicle; with ionic fascicle; chemical and electro-chemical etc.;
- nanosubassemblies technology, composed of elements with nanometric and subnanometric precision / integrated circuits; optical disks; LCD's; plasma display; optical fibers; inertial navigation systems; nanometric micro-machines and micro-devices;
- technology of highly intelligent products;
- systematization of micro and nanotechnologies / materials nanoprocessing for integrated circuits of very high density; processing MOS integrated circuits in interaction microscopic or quantum domain; materials nanoprocessing for nanomechanical components for nanotechnologies; microdevices of nanometric servopositioning for nanotechnologies; processing with ionic fascicle of materials in nanotechnologies; nanotechnology and micronanomachines etc.;

3. MEASURES AND ACTIONS FOR SUSTAINING NATIONAL PLATFORM «INTEGRATIVE MECHATRONICS»

Among the support measures and actions highlighted:

- Reassessment and updating of curricula and syllabuses of science "Integrative Mechatronics" by level of knowledge - education, university, postgraduate and academic compatibility and complementarity in Europe
- Reassessment and updating of manuals, books, laboratory guides, etc. in the field "Integrative Mechatronics", updates the appropriate field and revaluations and related documents;
- Implementation timetable education, university, postgraduate and academic, the "quantity of science "Integrative Mechatronics" in quality

- compared with similar European and international level;
- Creating and equipping laboratories / centers of expertise "Integrative Mechatronics" at European / international level, to the European / international high-level, at the existing levels of knowledge - education / university / postgraduate academic
 - Advanced Research Training Program in the area of "Integrative Mechatronics" and their release by competing for the realization of strategic projects for the development of science and industry "Mechatronics Integrators"
 - Involvement of national research - development institutes, universities and SMEs sites, all the profile, the development of investment in the area of "Integrative Mechatronics" in the immediate aftermath;
 - Participation in European/international consortia in achieving research area "Integrative Mechatronics" at most competitive parameters and efficient in the world to support sustainable science "Integrative Mechatronics" and "Integrative Mechatronics" industry;
 - Development of science and "Integrative Mechatronics" industry in Romania, in European and international trends, to support, sustain and develop an industry, economy and society and automated computer, as a society of tomorrow;

- Subnanometric accuracy **nanomesuring microsystems**;
- Nanometric accuracy **nanopositioning microsystems**;
- High intelligent **systems**;
- **Etc.**

REFERENCES

- [1] Gh, Ion Gheorghe: Microingineria Inteligentă, CEFIN Publishing House, 2009, ISBN: 978-606-92267-2-8;
- [2] Blattner, J. und Neußer, S. "Fuzzy-Systeme und Neuronale Netze", Mikroelektronik, 1993 (3), Fachbeilage "Mikrosystemtechnik"
- [3] Matlac, I - Mecatronică, Evoluția și caracterizarea sistemelor tehnice; U. Transilvania Publishing House, 2002

4. EXAMPLES OF INVESTMENT ENDOWMENTS

Some of the investment endowments are:

- **Digital instrumentation / laboratory devices / mechatronic equipments** for laboratory processes, applicable processes, for demonstrations, operation, for servicing etc.;
- **Mechatronic boots** for simulations, experimentations, tests, trials etc.;
- **Robots** for education;
- **Robots** for industrial application in laboratory environments in laboratory conditions, of pilot technology, etc.;
- **Technological CNC systems**;
- **Flexible processing, assembly systems/lines** etc.;
- **Microelectromechanical Systems / MEMS**;
- **Nanoelectromechanica Systems / NEMS**;
- **Micro-nanotechnological machines**;
- **Micro-nanometric machines**;
- **Elemente** / componente pentru sisteme mecatronice;
- **Technological**, microtechnological and nanotechnological constructions;
- **Sensors** / microsensors / nanosensors;
- **Transducers** / microtransducers / nanotransducers;
- **Actuators / microactuators** / nanoactuators;