THE CORELATION BETWEEN MECHATRONICS AND EDUCATION

Cornelia Victoria ANGHEL
PhD. Eng. – „Eftimie Murgu" University of Resita – Computers Science Department
canghel@uem.ro

Keywords: *mechatronics, education, mechanical technology, electronics, computer science*

Abstract. The paper presents some aspects about the correlation between mechatronics and education.

Mechatronics is a new science of intelligent machines and denotes technological fusion of mechanics, electronics and computer-science.

Mechatronics was born as a technology and has become a worldwide spread philosophy. Through education, mechatronics principles aim at building a systemic thinking and at developing team-work skills. Mechatronics education provides more flexibility in acting and thinking, basic properties of a market-economy agent.

1. Introduction

The appearance of intelligent machines, since the middle of the last century, which marked the beginning of the second industrial revolution of the human society, coincides with the informatics revolution. Thus, machines and computerized complex aggregates with artificial intelligence were discovered, being able to function automatically. There are numerous examples of mechatronic products such as: the modern computing technique, the robots, spaceships, strategic planes, automatic machines-tools with numerical command, biomedical computerized apparatus, a.s.o.

Later, at the beginning of the VIII-th decade of the XX-th century, started the development of the theory of the intelligent machines introducing the notion of mechatronics, a Japanese certificate, (1972), which was accepted by most of the developed countries of the world.

Macaronis knows a rapid development, being a highly informatized science which followed the industrialized society and which will mark the economic, educational, cultural and social progress of humankind in the XXI-st century and even in the Third Millennium.

2. Mechatronics

The transit from the industrialized society to the highly informatized one was determined by the second mankind's industrial revolution, which started around 5 decades ago, marking the replacement of man's intellectual work with the services of the computers and the intelligent machines.

Mechatronics is a new philosophy, certified in 1972 by the Japanese specialists from the Yaskawa Electric Company, which defines the synergetic fusion of three technologies: mechanics, electronics, and informatics.

Mechatronics marks in engineering practice the jump from the sequential engineering (classic) to the simultaneous one (competing), and in education the passing from broad narrowed specialist engineer to the specialist engineer with a systematic conception of mechatronic thinking, flexibility and work team, preoccupied with the mechatronic product performance when designing, manufacturing and promoting them on a worldwide competition.

The first program of mechatronic education in the world was elaborated in 1978 in Japan being destined to the Technical University of Toyohashi, a recently founded higher education unit!

3. Evolution of mechatronic technology and of the relations in society

The evolution of relations between the mechatronic technology and the human life within the industrialized and the highly informatized society is presented as a scheme in Fig.2.

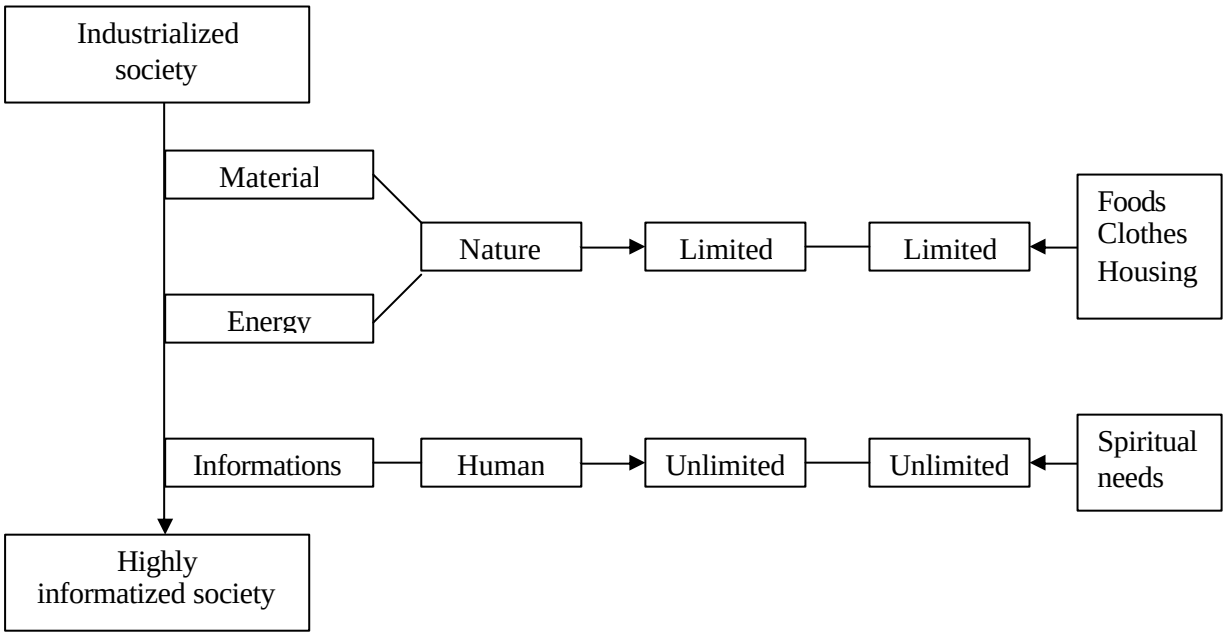

Fig.1. Evolution diagram of the relations between society, mechatronic technology and life.

We can notice that the traditional technologies operate with two components: material and energy, and the mechatronic technology with three components, the third being the information.

We anticipate that in the near future the technology of the Third Millennium will evolve as shown below:

Mechatronics → Micromechatronics → Nanomechatronics → Biomechatronics.

4. Short history of mechatronics

a) In the technologically developed countries:

1972 – Certifying of the term „Mechatronics" by the company Yaskawa Electric Cp (Japan).

1978 –First Japanese Program of mechatronic education at the Technical University of Toyohashi.

1986 – European Community, through the Consultative Committee for Research and Development decreed the „Mechatronics – a major objective for European education and research."

1988 - IRDAC organised the first course of Mechatronics at T.H. Aachen, K.U. Leuven and Cranfield Institute Technology.

1995 – The European Community financed the ADAPT Program defining the standards of preparing a „smart mechanical engineer".

In USA, Mechatronics was approached systematically in the educational and scientific research programs ever since the 8th decade of the XX-th century. In 1994 was published the Program of Developping the Mechatronic education in USA and the perspectives of State University of Louisiana in the field of mechatronic education (Hirschfeld, R.A., Liao, T.W., Keys, L.K., Magazine Mechatronics, vol.4, No.3, pp233-246).

b) In România:

1992 – Foundation of the Departments of Mechanisms, Fine Mechanics, Mechatronics and at the Technical University Cluj-Napoca.

1998 – Comes aut the first course of Mechatronics, author Maties, V., Dacia Publishing House, Cluj- Napoca.

05.06.1998 – Foundation of the Romanian Society of Mechatronics (SROMECA), President Prof univ. dr. eng. N. Alexandrescu, University „Politehnica" Bucuresti , (St. Anghel – charter member).

08.02.1999 – The Ministry of National Education founds the National Council of Technological Education and Innovation (C.N.E.T.I.), (first author of these lines being a charter member). C.N.E.T.I. elaborates The National Program of Mechatronic Education (PNEM).

19.03.1999 - C.N.E.T.I. elaborates the reference objectives of The National Program of Mechatronic Education (PNEM).

15.01.2000 – Comes aut the academic course „Actuatori in Mechatronics", author Vistrian Maties a.o., Mediamira Publishing House, Cluj - Napoca.

1995 – 2001 – Foundation of Departments of Mechanisms, Mechatronics, Robots, Design, at the Engineering Faculties at: Bucuresti, Brasov, Timisoara, Iasi and Suceava.

5. Main objectives of the Romanian Mechatronic education

On the 19th March1999 C.N.E.T.I elaborated 24 objectives of PNEM, some of them being presented below:

- Approaching of mechatronics as national priority in the programs of education and research;
- Defining some standards of the departments and mechatronic collectives self evaluation;
- Creating a national database regarding the human resources and the mechatronic materials;
- Supporting the foundation of the specialization „Mechatronics" at the Engineering Faculties;
- Establishing the minimum configurations of the academic mechatronic laboratories;
- Identifying the financial sources for the equipment of these laboratories;
- Founding the Excellency Centers in the field of mechatronics;
- Supporting the periodic organization of national mechatronic seminars;
- organizing academic courses in mechatronics;
- elaborating some educational plans and some academic manuals to ensure the trening of some trainers in mechatronics;
- Dissimination of the mechatronic experience achieved through international collaborations financed through programs such as: TEMPUS, Socrates, Leonardo da Vinci, Phare VET, World Bank, etc.;
- Stimulating the student, teachers and mechatronic oriented researcher's mobility;

- Supporting the researchers of mechatronics to participate at international scientific manifestations;
- Introducing mechatronics in the student manuals a.s.o.

5. Basic functions of the mechatronic system. Actuator.

The automatic plant of the future will work with robots and evolved automatic tools and will dispose of complex mechatronic systems created with microprocessors. These have a hardware structure and a multitude of software adequate to the four basic functions of the mechatronic system i.e.:

-the function of material, energy and information conversion;
-the function of the energetic flux transmission;
-the control function;
-the structural function (the elements are disposed in accurate positions).

The Actuator is the main hardware component part of a mechatronic system, which transforms the signal received from the multiprocessor in a mechanic work, which on its turn enters the mechanism that ensures the adaptation of the mechanic energy at the served technological process parameters. The characteristic structure of an Actuator is presented in Fig.3:

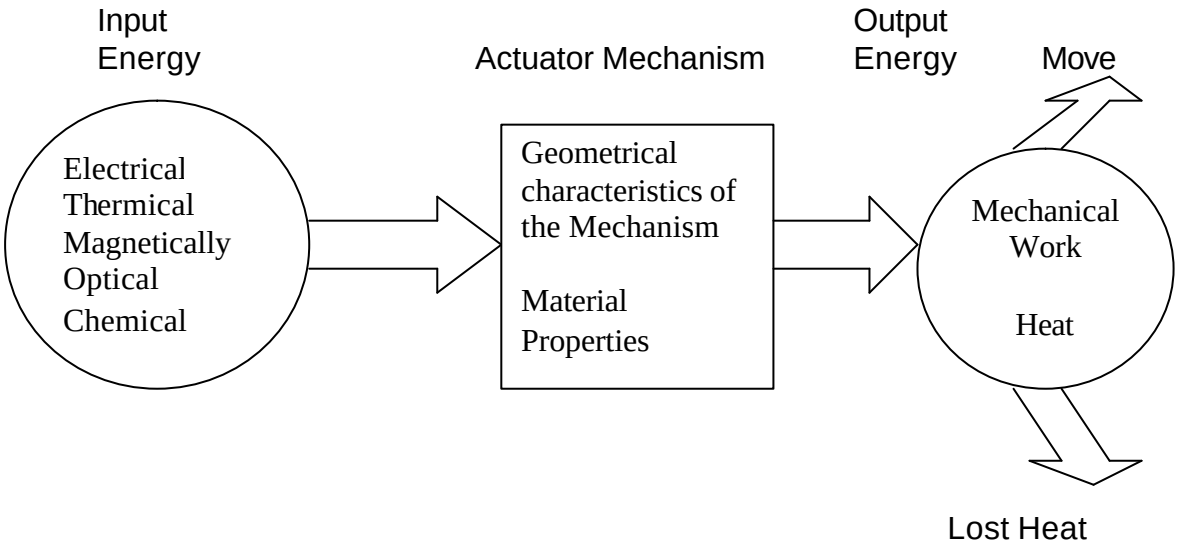

Fig.3. The diagram of an Actuator structure

In the course „Actuators in Mechatronics”, author Vistrian Maties a.o.., Mediamira Publishing House, Cluj – Napoca, the following types of Actuator are studied: electromagnetic linear, made of alloys with a form memory, electrostatic, piezoelectric, magnetostrictive, electro and magnetoreologic, thermal, phase transforming-based, chemical reaction based, biological, optical, electrohidrodynamical, diamagnetical and with physical-chemical phenomena.

6. Mechatronics – Productica

Mechatronics – is the philosophical notion globally accepted through the above mentioned Japanese certificate.

Productica is a philosophical notion which defines the computer based integration of conception, fabrication and management of the product (material or service) destined to the consumer.

The term Productica was introduced by German and Romanian specialists who dealt with Robotics and the implementation of industrial robots in flexible cells and in the flexible automatic fabrication lines, as essential structural elements of the automatic plant of the future.

Productica is a multidisciplinary border science built through the joint of Physics, Economy, Marketing, Electronics, Informatics, Computer Science, Automatics, Robotics, Logistics, Management, Industrial Engineering.

In our country the promoters and the advocates of Productica are the scholars: Fr. Kovacs, M. Ivanescu, T. Muresan, a.o.

The open and loyal dialog, started at „The 8th Symposium of Mechanisms and Mechanic Transmissions", Timisoara 19th-22nd Oct. 2000, between the Romanian exponents and Fr. Kovacs (Productica) and V. Maties (Mechatronics) tends to keep on elucidating the priorities and the interaction of the definition spheres of the two related modern philosophies.

7. Mechatronics - Education

From the beginning of the XX-th century through the writings of the scholar Charles Peguy, quoted in the book of Louis De Broglie (1966), was defined the categorical opposition between science and education through the statement: „There is nothing so opposed the functions of science than the functions of education because the functions of science request a perpetual silence, as the functions of the education request an definite certainly. The contradiction is real, but life shows that there is a good compatibility, because great researchers were also prestigious teachers. The maturization of some real researchers, with talent imagination, ingenuity and with a real call for the scientific progress, led to their wish to send the students the experience and the collected knowledge.

The education is dogmatic and presents an image of the real scientific phenomena, which usual are time variables. This dogmatism gives credibility to the education. In science we must accept also the possibility of some various phenomena, even paradoxes, which most of the times led to great discoveries. The scientific research and education

Scientific research and education are inseparable, because one is a source of supply for the other one and ensures the prosperity of the highly informatized society. The great coryphaeus of the academic education were also scientific scholar researchers. Technical universities worldwide were and still are the promoters of the fundamental scientific research, and with their laboratories they promoted the application scientific research, sometimes even the developing scientific research.

The organization of the improvement through doctoral degree of the young talented specialists in universities made the presence of teachers more and more important in the progress of the highly informatized society.

We assume the risk to predict that, if the progress of mechatronic science, of education and globalize economy will erode the antagonism between those 30% rich people and those 70% poor people, by eradicating the poverty, then there might be a chance for the current miseries of the human society to disappear: terrorism, wars, organized crime, traffic with guns, drugs, children etc.

8. Conclusions

Mechatronics is a new philosophy, certified in 1972 by the Japanese specialists, which defines the synergetic fusion of three technologies: Mechanics, Electronics and Informatics.

Mechatronics is the science of the highly informatized human society's intelligent machines, characteristic for the XXI-st century and the beginning of the III Millenium.

Education and the mechatronic science are inseparable, because one is a source of supply for the other one and ensures the prosperity of the highly informatized society.

Mechatronics was approached 30 years ago in Japan, followed by USA, the European Community and other countries with research and educational potential. Mechatronics imposed also the adoption of some new educational programs, which could lead to the step to sequential (classic) engineering and the simultaneous (competing) engineering. Mechatronic education marks in engineering practice the jump from the sequential engineering (classic) to the simultaneous one (competing), and in education the passing from broad narrowed specialist engineer to the specialist engineer with a systematic conception of mechatronic thinking, flexibility and work team, preoccupied with the mechatronic product performance when designing, manufacturing and promoting them on a worldwide competition.

As a conclusion, we affirm that education and science mechatronics are inseparable, because one is a source of supply for the other one and ensures the prosperity of the highly informatized society.

Bibliography

[1]. Anghel, St. – *Mecatronica – stiinta actuala si de perspectiva a dezvoltarii societatii umane a secolului XXI.* Analele UEMR, Fasc. Inginerie, Anul VII, Nr.1, Resita, 2000;

[2]. Kovacs, Fr., s.a. – *Fabrica viitorului. Introducere în Productica: Integrarea prin calculator a conceptiei, fabricatiei si a managementului.* Editura Multimedia International Arad,1999;

[3] Maties, V., s.a. – *Tehnologia mecatronica si mecanismele.* Lucrarile SYROM'97, Vol.1, Bucuresti, 1997, pp.161-166.