Mechatronics and Integronics Galaxy – Basis and Support for Strategic National and European Education, Research and Development

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Abstract: Mechatronics and Integronics Galaxy launches a new integrative science, a new generative and integrative and synergistic concept, with an intelligent and adaptive new concept, a spatial and temporal integration, a permanent and predictive flexibility, a simultaneous mix-integrative conception and a technical, technological and ecological strategy for the impact in economics, industry and society.

Keywords: Mechatronics and Integronics Galaxy, generative concept, integrative science; education; research; strategic development.

1. INTRODUCTION

Mechatronics and Integronics Galaxy, in this first apparition and original expression as a science, denomination, vision, concept, integration and strategy of technical, technological, economical, ecological, educative, scientific impact, represents a global assembly of fundamental knowledge of scientific discoveries in the field and of the advanced high-tech solutions applicable in intelligent and automated fabrications.

In this philosophical structure, Mechatronics and Integronics Galaxy develops the global conceptual system of mechatronic and integronic systems and products, intelligent fabrication systems in high efficiency, high competitive and high added-value solutions and excellent hardware and software, with superior performances.

Therefore, Mechatronics and Integronics Galaxy develops innovation conception of fusion structures, functions and solutions at a macro, micro and nano scale for intelligent systems and technologies and new generations, towards new other generations of them, connected into “component massive networks”, for achieving composed functions and ensemble functions, integronizes pluri-disciplinary sciences, appeals at intelligent materials, high advanced technologies, neural softwares, etc.

2. MECHATRONICS AND INTEGRONICS GALAXY STRUCTURE AND FIELD

Appealing to the defining and applicable potential of the Mechatronics and Integronics Galaxy, its structure and field, encompasses the fields of Mechatronics / μMechatronics / nMechatronics, Sensorics / μSensorics / nSensorics, Actuatronics / μActuatronics / nActuatronics, Robotics / μRobotics / nRobotics, Integronics / μIntegronics / nIntegronics, all in an auto-adaptativity, flexibility and high complexity, in a mathematical modeling of the processes and products as well as a science of flexible generation of the movements and interactions with the environment.

Furthermore, are presented in completion the following components’ matrix. The “MICROSSENSORICS” field fits up the industrial environment with adequate tools that are meant to ensure the assessment and the management of the production processes in most “work scenarios” by offering a complete monitoring of the industrial and of the economical activities through the functions of the sensors / micro-sensors and transducers / micro-transducers.

By the sensorial functions of sensors / micro sensors and transducers / micro transducers [automated sensorial function, additive sensorial function, gustative sensorial function. Kinematics sensorial function (displacement, speed, acceleration) and so on] integrated on sensorial levels and informational levels that restore the state and the quality of industrial processes and products.

The μSENSORICS Flow chart comprises the following elementary matrix and system structure and is depicted in fig. 1.

Consequently, the μSENSORICS field integrates and integronizes organically and synergistically the new knowledge and the entire culture on sensors / micro sensors, transducers / micro transducers and informatics / micro informatics in order to prepare, carry out and develop a new Mechatronics and Integronic Industry, compatible with the Knowledge-based Society of tomorrow.
Hence, ROBOTS and μROBOTICS are useful when it comes to serving various technological processes and equipments and, respectively, to developing certain applications with a flexible structure an one that is entirely automated, leading to the development of entirely automated work stations or plants.

The “μROBOTICS” Field, through its management / organizing role, helps at interconnecting technologies and computerized stations in order to integrate them in the culture / field of micro-robots and nano-robots and, respectively, in the creation of a modular / flexible cell-based industry, all these in order to cover certain needs related to automation such as:

a) measuring small and extra-small pieces;
b) certain work tasks;
c) production and manufacturing needs;
d) mechatronic, micro-industrial product micro-assemblage;
e) non-destructive transportation of the industrial pieces in different phases of the assemblage and positioning process;
f) etc.

The μROBOTICS Field has the following elementary and systemic matrix as shown in Fig. 2.

The applications of the μROBOTICS comprise very vast areas, with a strong influence according to the use micro-mechanisms / nano-mechanisms, the latter being structured from miniaturized conventional components and micro-tools, depending on their intelligence level, up to “CIP” structure.

3. EXAMPLES OF SMART TECHNOLOGY INTEGRATED IN THE AUTOMOTIVE INDUSTRY IN ROMANIA

- Technology and Intelligent mechatronic equipment for checking tightness in the auto mark: “coupler and differential carter” (fig.3).

Fig. 3. Intelligent mechatronic equipment for checking tightness in the automotive industry

Technical parameters:
- Functioning cycle: automated
- Supply pressure: 5÷6 bar
• Test pressure: 0.2 bar
• Automated measuring type: differences in pressure
• Wastage level over time: 15 cm³/ min
• Cycle time: 45 seconds

**Technology and mechatronic intelligent equipment to control diameters and axial level from "crankshaft"** (fig.4)

**Technical-functional characteristics:**
- Time measurement cycle: max. 50 sec.;
- Display Resolution: 0.1 µm;
- Measuring Transducers: 24 buc. / ZDB103 / race ± 1 mm;
- Industrial Computer: Central CMZ 200 ETAMIC / 220 Vca/ 50 Hz;
- Interface Mechanical device -Central: SATELLITE ETAMIC;
- Working Programs: Windows Operating System / Measurement Program INCDMTM Bucharest;

**Structure:**
- Control Table;
- Grounding and Control Mechanical Systems;
- Central CMZ 200 ETAMIC with Satellite SMD module.

**Technology and intelligent mechatronic equipment, to control the tightness at "Carter Oil S2G – Crude"** (fig.6)

**Technical-functional characteristics:**
- The pressure of compressed air supply: 4-6 bar;
- Pressure of regulator after work: 3 bar;
- Measuring cycle time: approx. 17 sec.;
- Display Resolution: 0.1 µm;
- Inductive measuring transducer: ZDB103 / ETAMIC / ± 1 mm;
- Pneumo-electronic measuring transducer: TPE 99 / 1 ETAMIC;
- Industrial Computer: Central CMZ 200 ETAMIC 220 Vca / 50 Hz;
- Mechanical Device-Central Interface: SATELLITE ETAMIC SMD;
- Working Programs: Windows Operating System / Measurement Program-INCDMTM Bucharest;

**Structure:**
- Control Table;
- Grounding and Control Mechanical Systems;
- Central CMZ 200 ETAMIC with Satellite SMD module.
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panel; • Wenglor immaterial barriers for protection; • Marking system.

• Technology and intelligent mechatronic equipment, to control the tightness "Carter Oil S2G - Factory" (fig.7)

Fig. 7

Technical-functional characteristics:
• Power supply: 220 V power ca / 50 Hz; compressed air 6 bar.
• Working Pressure (adjustable on the machine regulator): 5 bar;
• Control Pressure: 0.98 bar - low pressure circuit, 2.90 bar high-pressure circuit.
• Level of waste accepted: 25 cm³ / min;
• Cycle time: 60 sec.

Structure:
• Layer;
• A grounding system;
• Travel system of the work in measurement position;
• Systems-sealing closure of the work with rolls and pneumatic cylinders;
• Marking system;
• ATEQ Cell;
• Pneumatic panel;
• Electronic panel;
• Weng immaterial barriers.

• Technology and intelligent mechatronic equipment, to control the tightness "cylinder head" (fig.8)

Fig. 8

Technical-functional characteristics:
• Power supply: 220 V electricity ca / 50 Hz; compressed air 6 bar.
• Working Pressure (adjustable on the machine regulator): 5 bar;
• Pressure control: 1 bar;
• Level of waste accepted: 25 cm³ / min;
• Cycle time: 60 sec.

Structure:
• Layer;
• A grounding system;
• Travel system of the work in measurement position;
• Systems-sealing closure of the work with rolls and pneumatic cylinders;
• Marking system;
• ATEQ Cell;
• Pneumatic panel;
• Electronic panel;
• Weng immaterial barriers.

• Technology and intelligent mechatronic equipment, to control the tightness "cylinder head assembled motor F8Q" (fig.9)

Fig. 9

Technical-functional characteristics:
• Supply voltage: 220V / 50 Hz;
• Supply air pressure: 6 bar;
• Working pressure (regulator set on the machine): 5 bar; • Pressure control tightness: 1 bar;
• Loss tightness admitted: 25 cm³ / min; • Cycle time: 30 sec.

Structure:
• Layer; • Grounding system of the work;
• Travel system of the work in measurement position;
• Systems-sealing closure of the work with pneumatic cylinders; • Marking system; • ATEQ cell;
• Pneumatic panel; • Electronic panel; • Weng immaterial barriers.
Technology and intelligent mechatronic equipment, for uniformity profiles measured in "gears" (fig. 10)

![Image of mechatronic equipment](image)

**Fig. 10**

**Technical-functional characteristics:**
- Measuring range: ± 0.03 mm;
- Measurement area: ± 5 mm;
- Accuracy: 0.1 μm;
- Resolution: 0.01 μm;
- Fidelity: ± 0.0025 μm;

**Structure:**
- Mechanically fixing system;
- Mechanically grounding system for gears;
- Mechatronic systems for accurate measurement (4 units);
- Pneumatic drive system;
- Information system for processing and displaying data;
- Command drive system;
- Electronic system of immaterial barrier.

Technology and intelligent mechatronic equipment, to verify the tightness of "Carter mechanisms finished piece" (fig. 11)

![Image of mechatronic equipment](image)

**Fig. 11**

**Technical-functional characteristics:**
- Power supply: 220 V electricity ca / 50 Hz; 6 bar compressed air.
- Working Pressure (adjustable on vehicle regulator): 5 bar;
- Control Pressure: -0.5 bar;
- Level of waste accepted: 25 cm³ / min;
- Cycle time: 45 sec.

**Structure:**
- Layer;
- A grounding system;
- Travel system of the work in measurement position;
- Systems-sealing closure of the work with rolls and pneumatic cylinders;
- Marking system;
- Immateriel barrier of protection;
- ATEQ F520 cell with calibrated nozzles;
- Automatic programmable machine Siemens with operator panel;
- Pneumatic panel FESTO elements.

4. CONCLUSIONS

The concept of integration and multiplication of technical sciences through the mechatronic, robotic and integronic engineering underlies in fact the neuronal integration of technical, economical etc. disciplines, scientific fields and cultures and is to sustain and to develop the WORLD OF TOMORROW.

In conclusion, the scientific manuscript highlights the new systemic and synergetic vision of the intelligent micro-engineering in original conception of the authors and their advanced scientific experiences, in a complete compatibility with global scientific directions in the domain, but especially with the new technical and technological infrastructure, expressed through new intelligent and informatized products and systems which includes high added value, new scientific discoveries, new knowledge etc., clearly emphasized in the presented achievements and applications. The "<MECHATRONICS & INTEGRONICS galaxy>>, nowadays and in the future, certificated as a new concept of HIGH-TECH development and of integration of the most advanced completed systems of intelligent hard and software, attests on the one hand the originality and on the other hand the advanced scientific field for the future.

REFERENCES


