Mechatronics

MKT 1821

Chapter-3

Basic Definition

Mechatronics is an approach aiming at the synergistic integration of ***mechanic, electric and electronic, control theory, and computer science*** within product design and manufacturing, in order to *improve* and/or *optimize* its functionality.

It relates to the design of **systems**, **devices** and **processes** aimed at achieving an optimal balance between basic mechanical structure and its overall control.

French standard NF E 01-010

Basic Definition

- Computer science takes into account information processing and communication technology.

- Functionality takes into account the notion of “added value”

  the aim of mechatronics is to obtain an added value higher than the sum of added values of each function taken separately.

Mechatronic Product

The product with the ability to:

- perceive its environment,
- process information,
- communicate and act on its environment

with a full level of mechatronic integration from functional and physical points of view.

Mechatronic product is a generic term, which, depending on the sector of activities, includes notions such as

- system,
- autonomous sub-system,
- production equipment, etc.

Basic Definition

Mechatronics is the application of complex decision making to the operation of physical systems.

Mechatronics is a methodology used for the optimal design of electromechanical products.

A mechatronic system is not just a marriage of electrical and mechanical systems and is more than just a control system; it is a complete integration of all of them.

Basic Definition

"Mechatronics does not change the design process.

It gives the engineers greater knowledge, so the concepts that are developed are better, and communication with other engineering disciplines is improved.

The result is a highly balanced design."

Prof. Kevin Craig

Basic Definition

Mechatronics Engineering is the

- Analysis
- Design
- Manufacturing
- **Integration**

and maintenance of mechanics with electronics through intelligent computer control.

History of Mechatronic Engineering

- Mechanical Engineering experienced an exponential growth in the early 19th century because of the industrial revolution.

- The rise of semiconductors in the 1950s and computers in the 1980s have revolutionized all engineering products and processes which in turn affected mechanical engineering systems.

- The term mechatronics was first used in the late 1960s by a Japanese Electric Company to describe the engineering integration between mechanical “mecha” and electronics “tronics” systems.

History of Mechatronic Engineering

In the late 1970s, the Japan Society for the Promotion of Machine Industry (JSPMI) classified mechatronics products into four categories

- *Class I:*

Primarily mechanical products with electronics incorporated to enhance functionality. Examples include numerically controlled machine tools and variable speed drives in manufacturing machines.

- *Class II:*

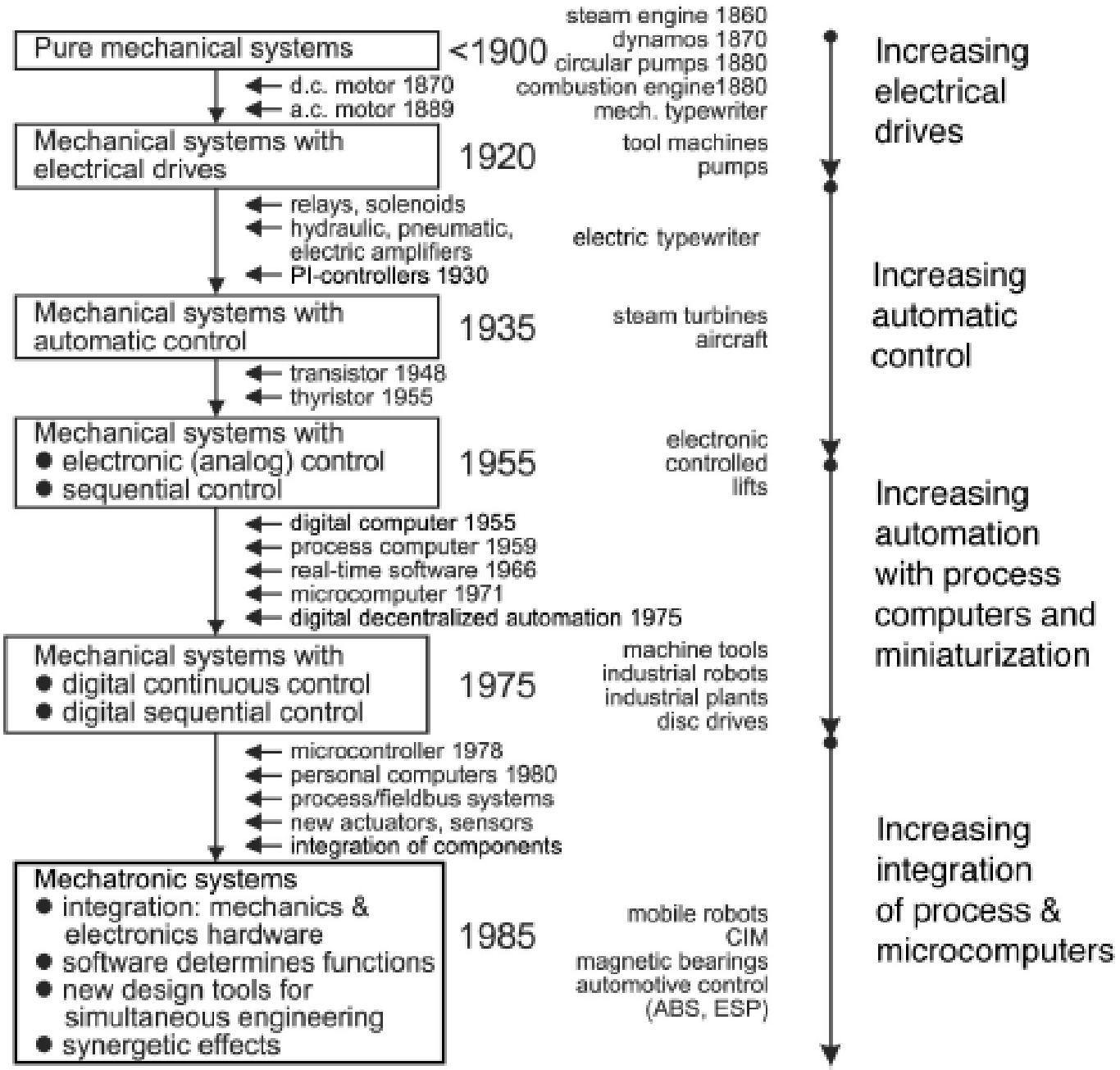
Traditional mechanical systems with significantly updated internal devices incorporating electronics. Examples include the modern sewing machine and automated manufacturing systems.

History of Mechatronic Engineering

Class III:

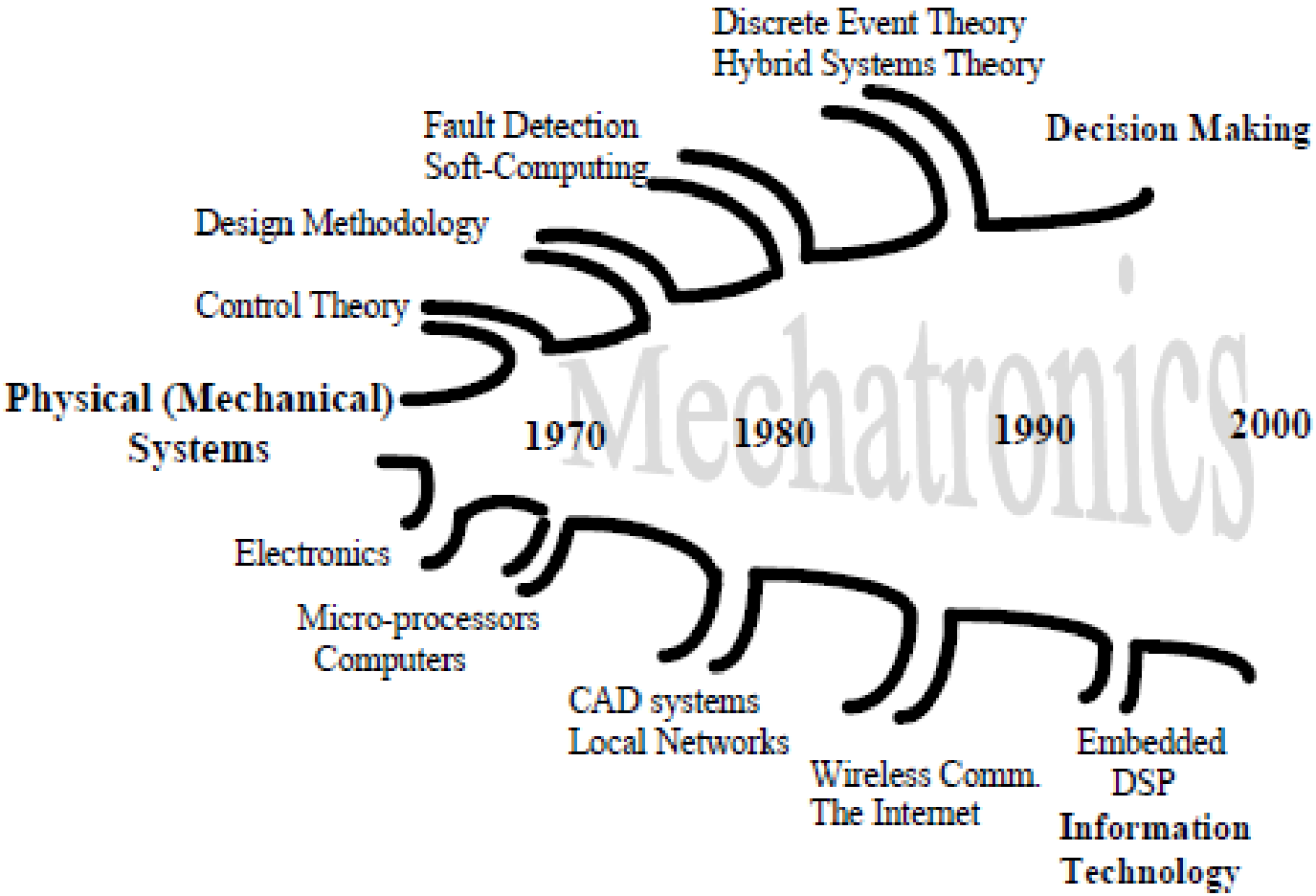
- Systems that retain the functionality of the traditional mechanical system, but the internal mechanisms are replaced by electronics. An example is the digital watch.

- *Class IV:*
  - Products designed with mechanical and electronic technologies through synergistic integration. Examples include photocopiers, intelligent washers and dryers, rice cookers, and automatic ovens.



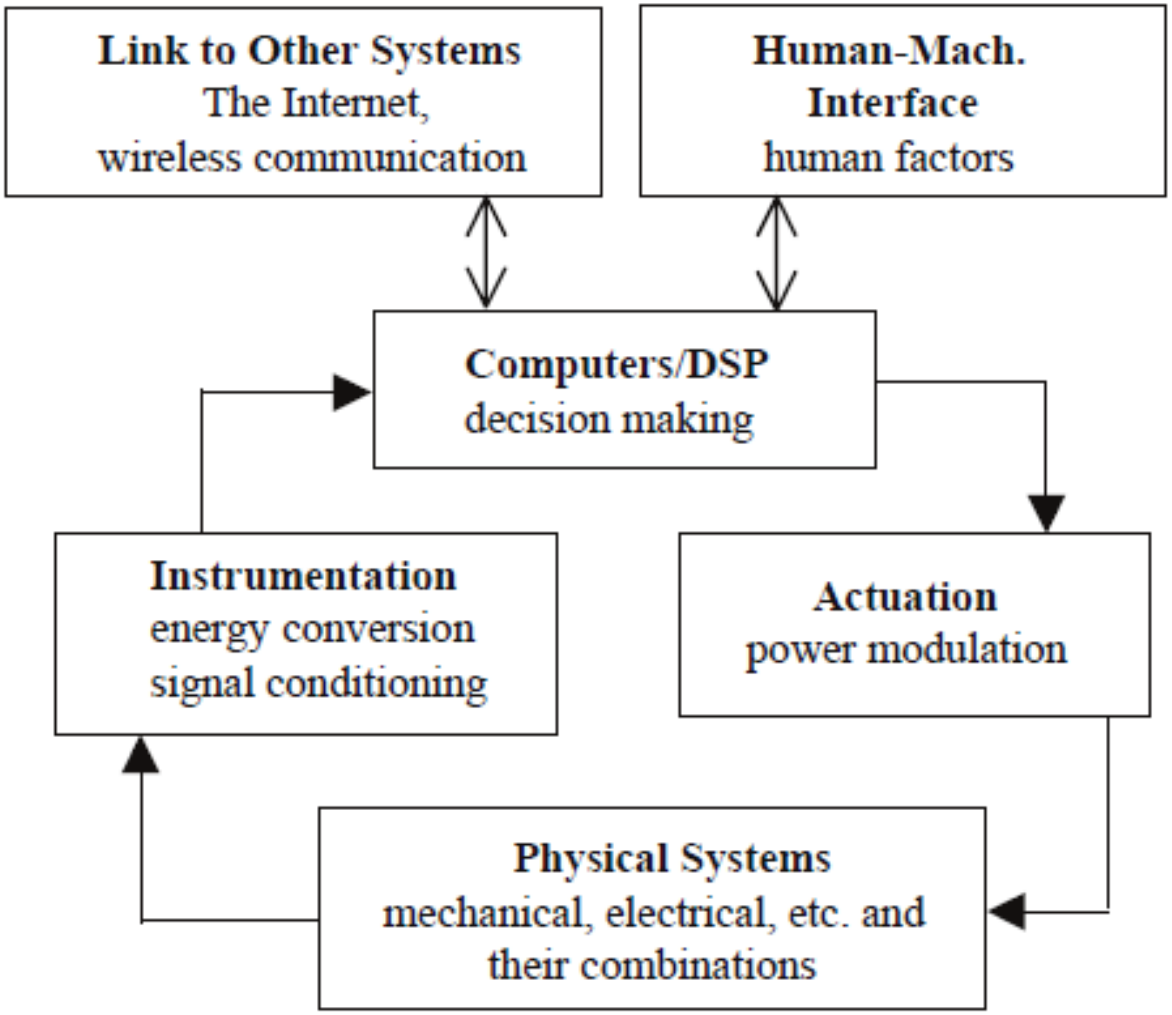
[Ref.] Prof. Rolf Isermann

History of Mechatronic Engineering



[Ref.] Prof. Tomizuka

Todays Mechatronics Engineering



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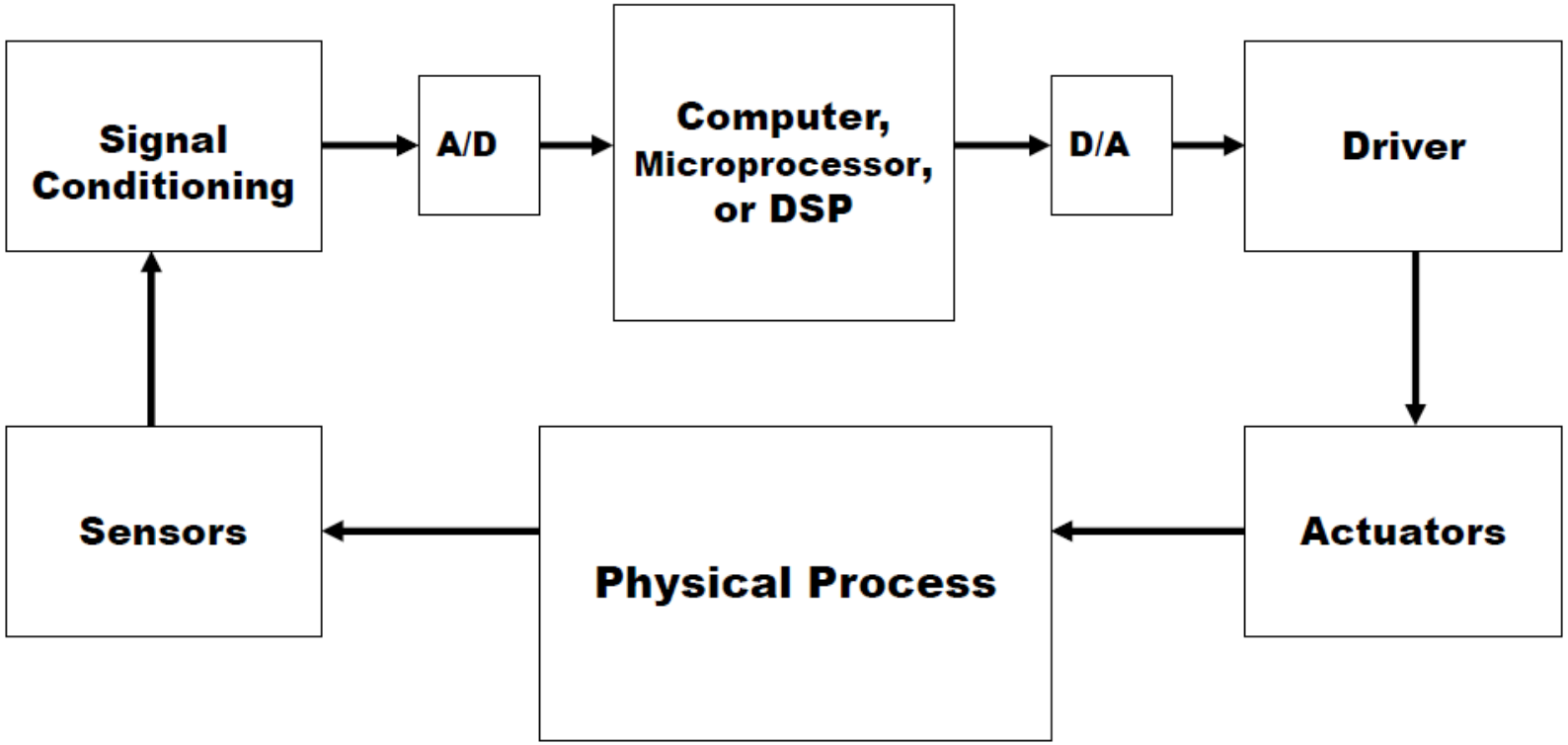
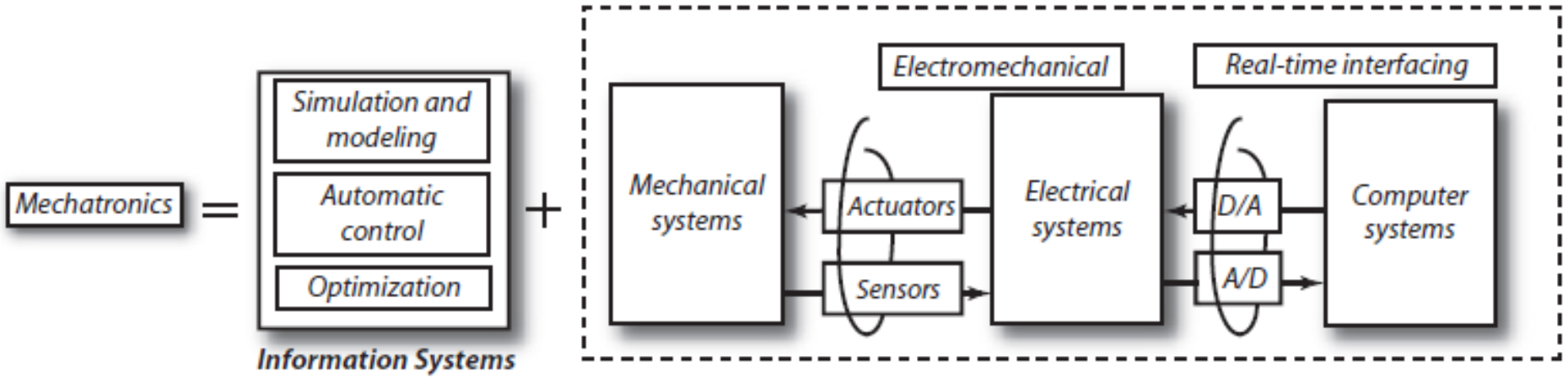
Mechatronic System



Mechatronic System



The Future of Mechatronic Engineering

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Mechatronic System

Automation and robotics	Machine vision
Automotive engineering	Mechatronics systems
Computer aided and integrated manufacturing systems	Medical systems
Computer Numerically Controlled machines	Packaging
Consumer products	Sensing and control systems
Diagnostic, reliability, and control system techniques	Servo-mechanics
Engineering design	Structural dynamic systems
Engineering and manufacturing systems	Systems engineering
Expert systems	Transportation and vehicular systems
Industrial goods	

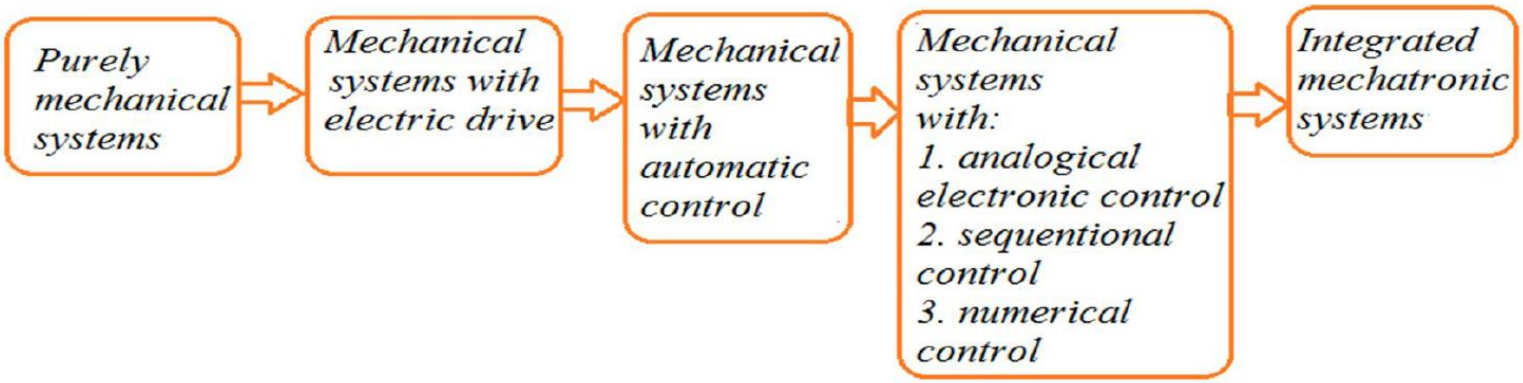
Mechatronic System vs Multidisciplinary System

The difference between a mechatronic system and a multidisciplinary system is not the constituents, but rather *the order in which they are designed.*

Multidisciplinary system design employed a sequential *design-by-discipline approach.*

Mechatronic design methodology is based on a concurrent (instead of sequential) approach to discipline design, resulting in products with more synergy.

Mechatronic System



Mechatronics is an **evolutionary** process, not a revolutionary one.

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