Introduction to Engineering Practice and Engineering Design

❑ A HISTORIC PERSPECTIVE OF ENGINEERING

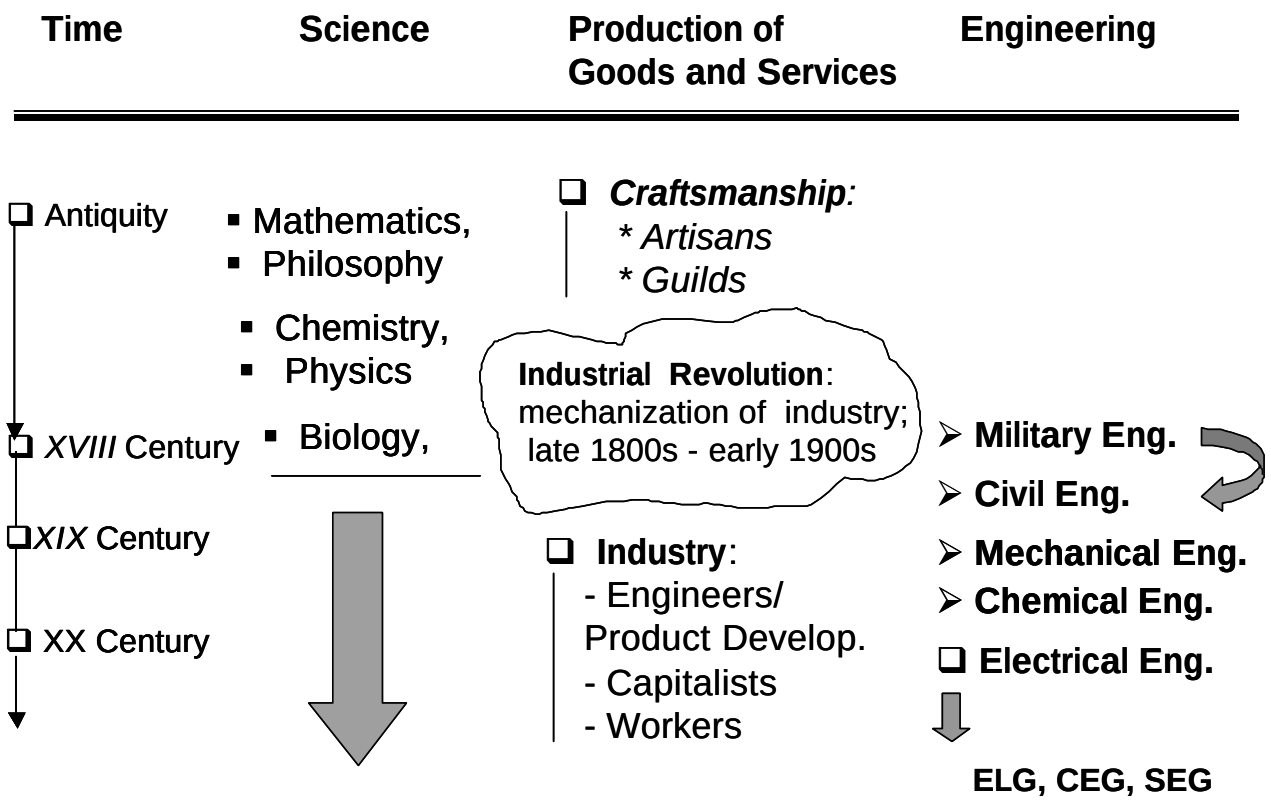

Fig. 1 A time perspective of the relations between science, industry and engineering (© *Emil M. Petriu)*

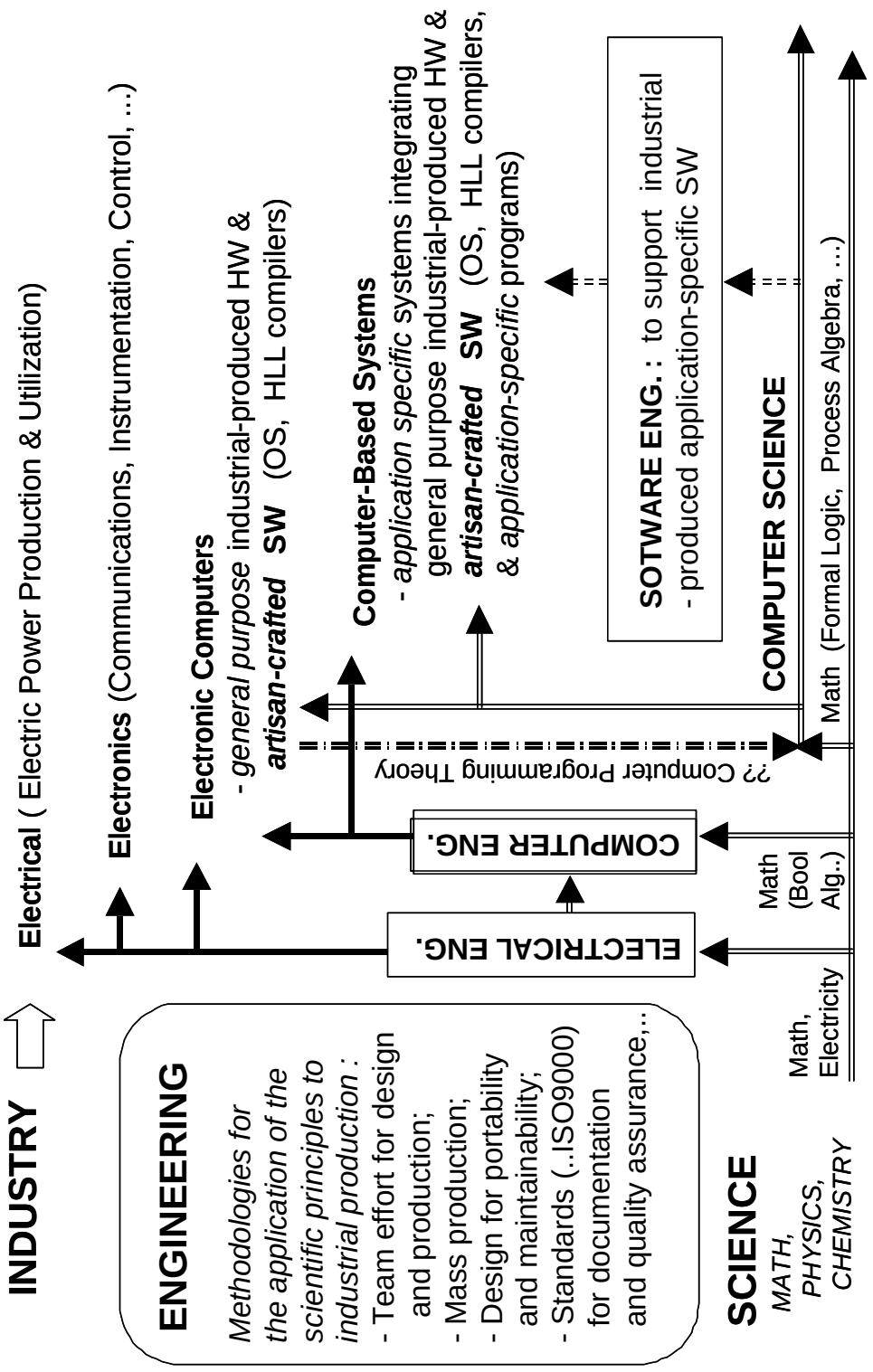

Fig. 2 Electrical, Computer, and Software Engineering (© *Emil M. Petriu)*

THE PRACTICE OF ENGINEERING

Definition of the Practice of Professional Engineering (G02-96):

The "practice of professional engineering" means any act of planning, designing, composing, evaluating, advising, reporting, directing or supervising, or managing any of the foregoing, that requires the application of engineering principles, and that concerns the safeguarding of life, health, property, economic interests, the public welfare or the environment.

ENGINEERING DESIGN

"Engineering design integrates mathematics, basic sciences, engineering sciences and complementary studies in developing elements, systems and processes to meet specific needs. It is a creative, iterative and often open-ended project, subject to constraints, which may by governed by standards or legislation to varying degrees depending upon the discipline. These constraints may relate to economic, health, safety, environmental, social or other pertinent factors." [*Canadian Engineering Accreditation Board – Accreditation Criteria and Procedures, 2000*]

ISO 9000 and ISO 14000

ISO 9000 standard was developed by the **International Organization for Standardization (ISO**) < http://www.iso.ch/iso/en/ISOOnline.frontpage >.

ISO 9000 consisting of a three-step cycle of planning, controlling, and documenting quality in an organization. It provides minimum requirements needed for an organization to meet their quality certification standards.

Quoting from *ISO 9000 and ISO 14000 in plain language:*

< http://www.iso.ch/iso/en/iso9000-14000/tour/plain.html > :

>> **ISO 9000** is primarily concerned with "quality management". Like "beauty", everyone may have his or her idea of what "quality" is. In plain language, the standardized definition of "quality" in ISO 9000 refers to all those features of a product (or service) which are required by the customer. "Quality management" means what the organization does to ensure that its products conform to the customer's requirements.

ISO 14000 is primarily concerned with "environmental management". In plain language, this means what the organization does to minimize harmful effects on the environment caused by its activities.

Both ISO 9000 and ISO 14000 concern the way an organization goes about its work,
and not directly the result of this work. In other words, they both concern processes, and not products – at least, not directly. Nevertheless, the way in which the organization manages its processes is obviously going to affect its final product. In the case of ISO 9000, it is going to affect whether or not everything has been done to ensure that the product meets the customer's requirements. In the case of ISO 14000, it is going to affect whether or not everything has been done to ensure a product will have the least harmful impact on the environment, either during production or disposal, either by pollution or by depleting natural resources.

However, neither ISO 9000 nor ISO 14000 are product standards. The management standards in these families state requirements for what the organization must do to manage processes influencing quality (ISO 9000) or the processes influencing the impact of the organization's activities on the environment (ISO 14000).

In both cases, the philosophy is that these requirements are generic. No matter what the organization is or does, if it wants to establish a quality management system or an environmental management system, then such a system has a number of essential features which are spelled out in ISO 9000 or ISO 14000. <<

PROJECT MANAGEMENT

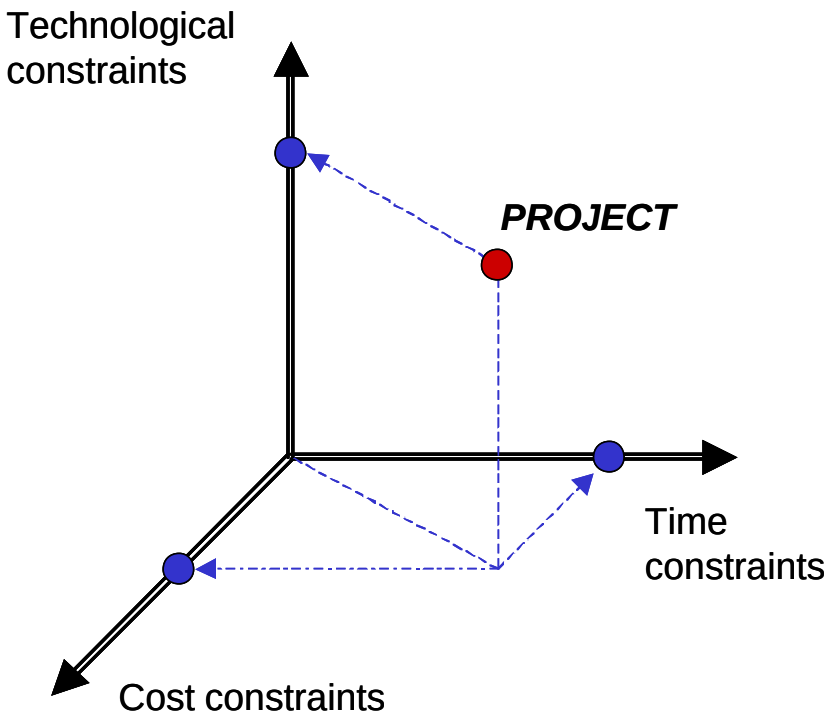

Fig. 3 Constraints affecting a project

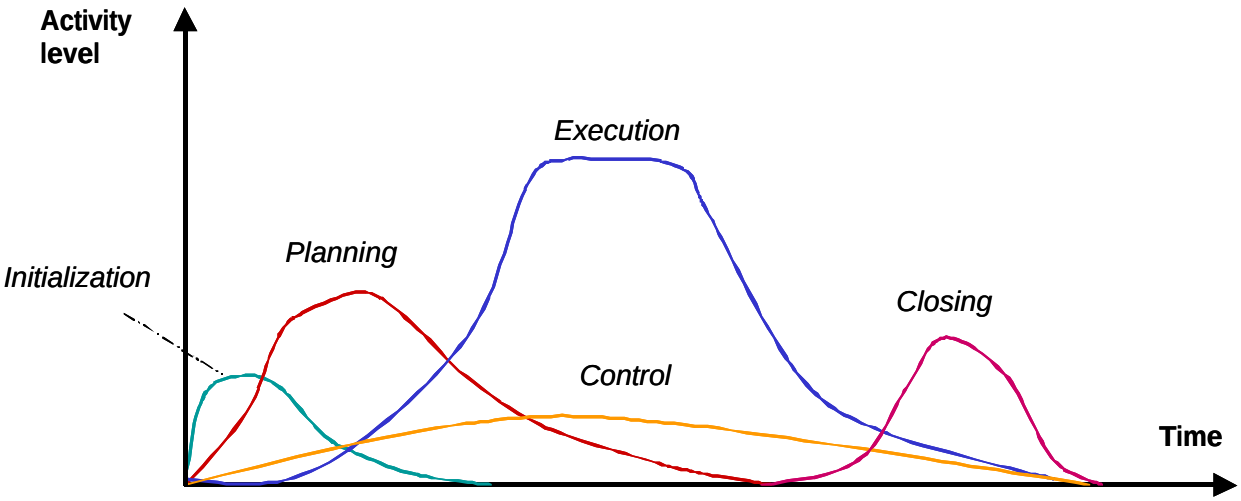

Fig. 4 Project phases

DESIGNING A COMPLEX ELECTRONIC SYSTEM

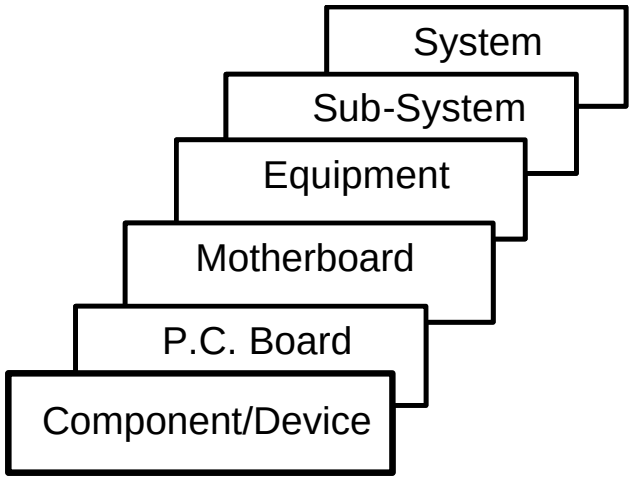

Fig. 5 Design levels

- {Design+Test+Analysis} **Synergy**
- **EMC_Behavior** = *F* (Design_Principle, Analysis&Modeling&Simulation_Tools, Test_Methodology&Instrumentation)

Fig. 6 Designing for Electro Magnetic Compatibility (EMC)

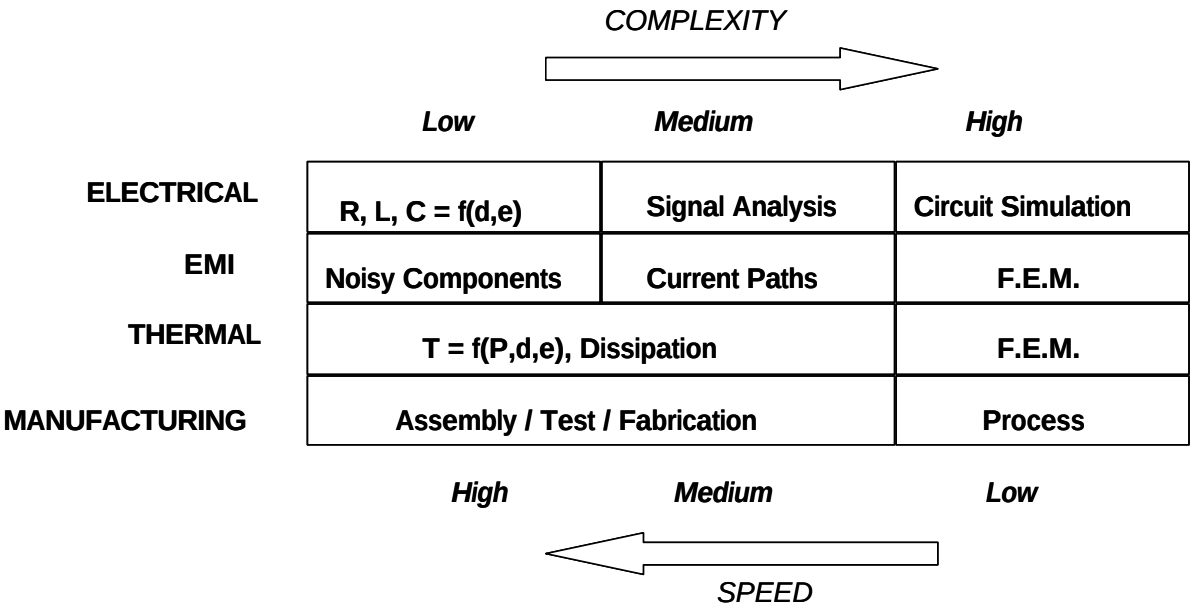

Fig. 7 Multiple-domain levels of design

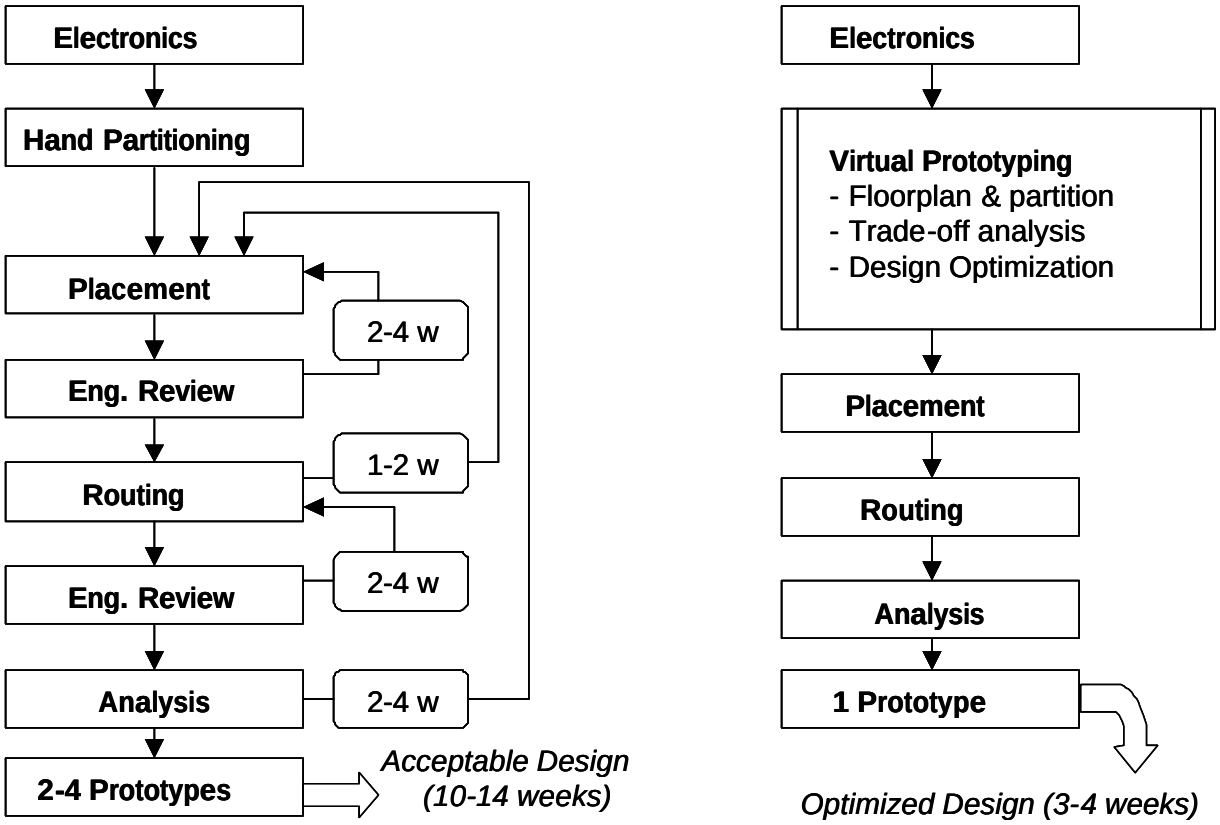

Fig.8 Design cycles for the traditional and the concurrent-engineering approaches