RME 3102: Design Process of Mechatronic Systems

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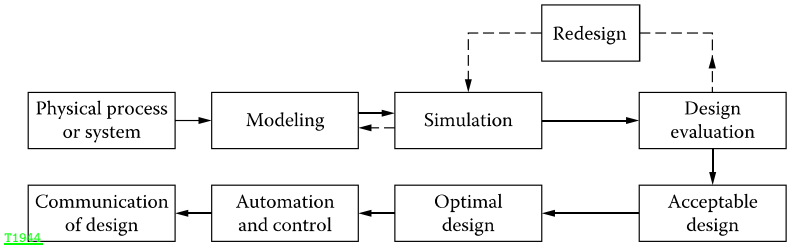
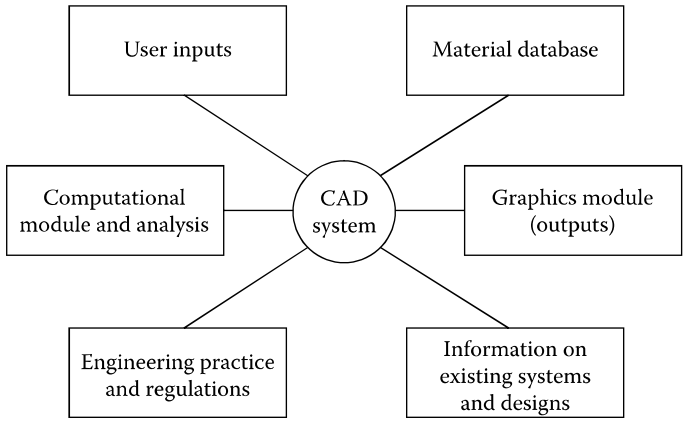
Steps in Design & Optimization of Product



T1944

Various steps involved in the design and optimization of a mechatronic system and in the implementation of the design.

Various Elements in Computer Aided Design



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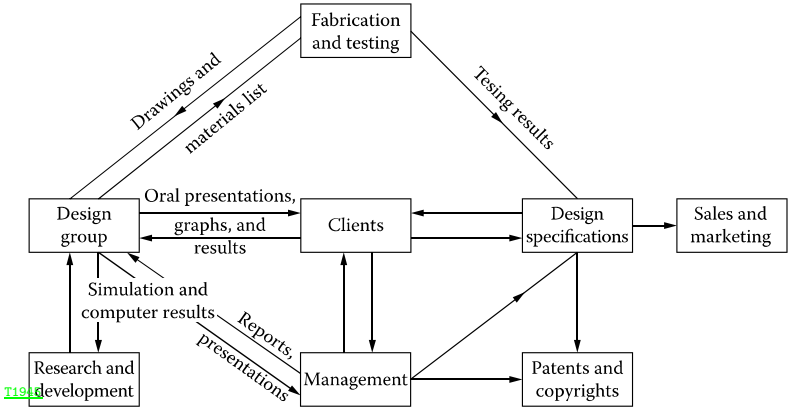
Various elements or modules that constitute a typical computer-aided design system.

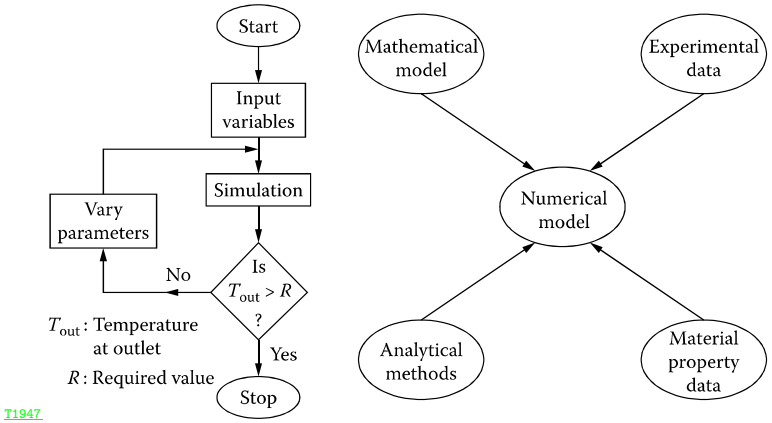
Communication in the Design Process



T1946

A possible scheme for different levels of communication at the conclusion of the design process.

Modeling



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Numerical Model

Mechatronic System Design

Properties of conventional and mechatronic designed systems

conventional design	**mechatronic design**
added components	**integration of components (hardware)**
1 bulky 2 complex 3 cable problems 4 connected components	compact simple mechanisms bus or wireless communication autonomous units
simple control	**integration by information processing (software)**
5 stiff construction	elastic construction with damping by electronic feedback
6 feedforward control, linear (analog) control	programmable feedback (non-linear) digital control
7 precision through narrow tolerances	precision through measurement and feedback control
8 non-measurable quantities change arbitrarily	control of non-measurable estimated quantities
9 simple monitoring	supervision with fault diagnosis
10 fixed abilities	adaptive and learning abilities

T1948

conventional design	**mechatronic design**
added components	**integration of components (hardware)**
1 electromechanical typewriter 2 mechanically controlled injection pump with rotating piston 3 many wiring 4 belt-driven auxiliaries	electronic printer high pressure pump and magnetic injection valves (common rail) bus cable decentralized driven auxiliaries
simple control	**integration by information processing (software)**
5 stiff drivetrain	elastic drivetrain with algorithmic damping through engine control
6 mechanical gas pedal	electronic non-linear throttle control
7 feedforward-controlled actuator	feedback-controlled actuator with friction compensation
8 manual steering of cars during spinning	feedback control of slip angle by state observer and individual wheel braking
9 monitoring of exhaust gases through maintenance or inspection	on-board misfire detection by speed measurement of engine crankshaft
10 rail vehicles	mobile vehicle with automatic navigation

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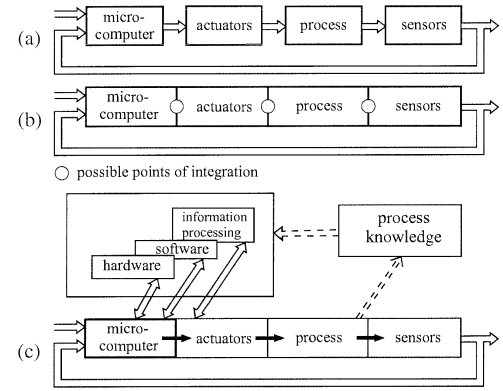
Integration of mechatronic systems



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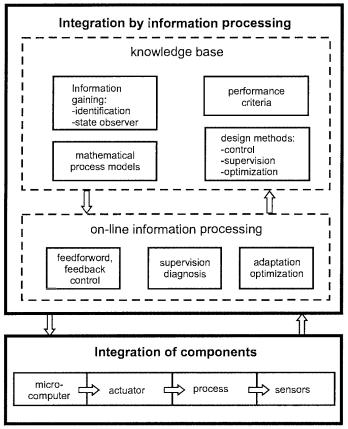
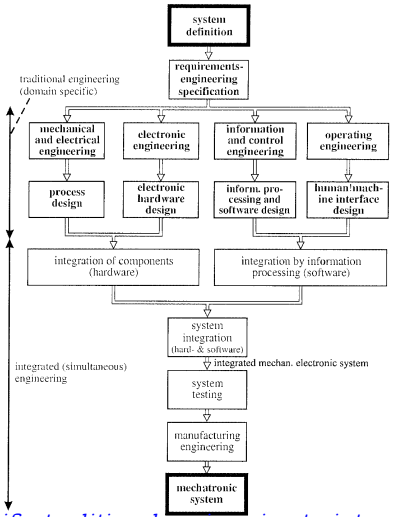
(a) general scheme of a (classical) mechanical-electronic system; (b) integration through components (hardware integration); (c) integrationthrough functions (software integration)

Integration of mechatronic systems



T1951

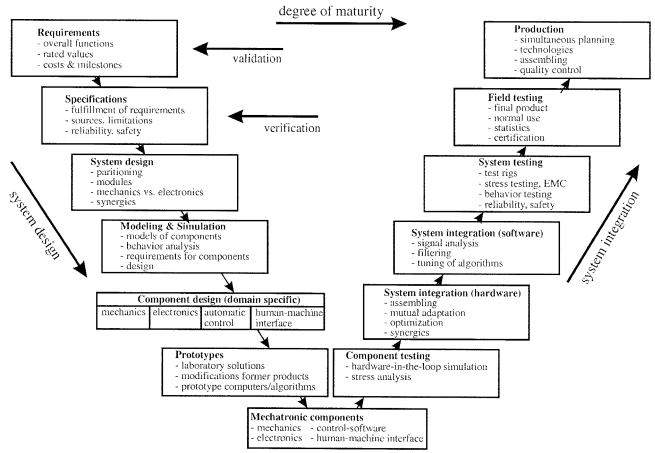
Integration of components (hardware integration); integration by information processing (software integration)



T1952

From domain specific traditional engineering to integrated, simultaneous engineering (iteration steps are not indicated)

A "V" development scheme for mechatronic systems



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