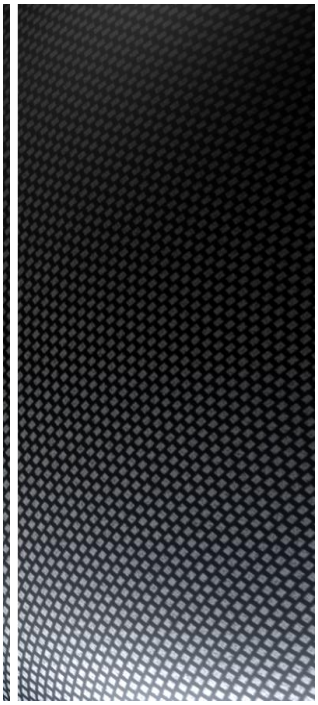


CIM (21-548)

Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

Session # 14

Course Description

- *Instructor*
  - *Omid Fatahi Valilai, Ph.D. Industrial Engineering Department, Sharif University of Technology*
  - *Email: FValilai@sharif.edu , Tel: 6616-5706*
  - *Website: Sharif.edu/~fvalilai*
- *Class time*
  - *Sunday-Tuesday* *09:00-10:30*
- *Course evaluation*
  - *Mid-term* *(30%)*
  - *Final exam* *(50%)*
  - *Quiz* *(5%)*
  - *Exercise* *(15%)*

Course Description *(Continued ...)*

- *Mid-term session:*
  - *Sunday: 16th Azar 1393, 09:00 ~ 10:30*
- *Final Exam:*
  - *Tuesday: 30th Dey 1393, 15:00 ~ 17:30*
- *Reference:*
  - *Schaefer, D., Cloud-based Design and Manufacturing (CBDM): A Service-Oriented Product Development Paradigm for the 21st Century, . London: Springer, 2014*
  - *Koren, Y., "The Global Manufacturing Revolution", Wiley, 2010*
  - *Nasr, A., "Computer-Based Design and Manufacturing An Information-Based Approach",Springer, 2007*
  - *Mitchell, F.H., "CIM Systems: An Introduction to Computer-Integrated Manufacturing", Prentice Hall College Div; 1St Edition edition (January 1991), ISBN: 978-0131332997*

Course Description *(Continued..)*

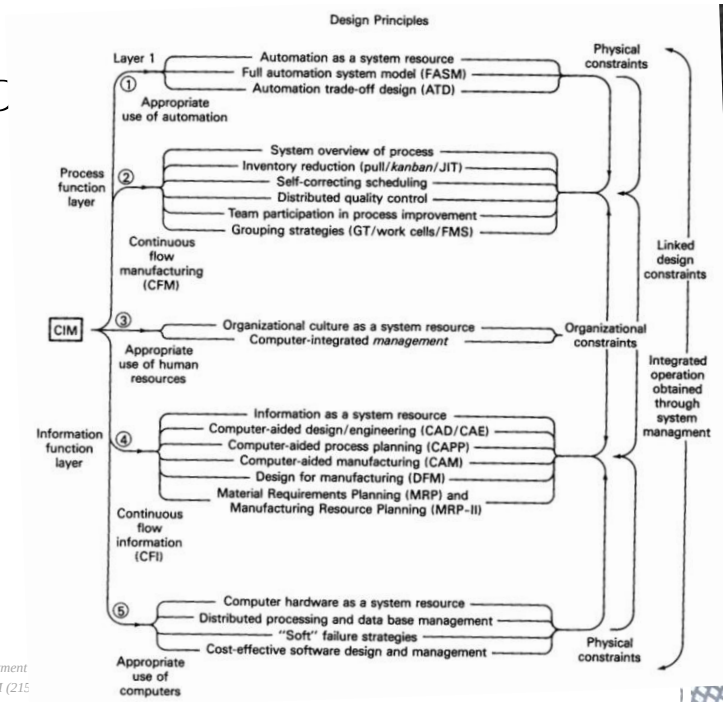
- *Contents:*
  - *Globalization and Manufacturing Paradigms* *(8 sessions)*
  - *System Concepts* *(3 sessions)*
  - *Evolution of Manufacturing systems* *(2 sessions)*
  - *Manufacturing System Design* *(4 sessions)*
  - *Manufacturing Equipment Design* *(3 sessions)*
  - *Information flow in Manufacturing Systems* *(4 sessions)*
  - *Product design and Manufacturing System* *(3 sessions)*
  - *Manufacturing System Implementation* *(5 sessions)*

Course Description *(Continued..)*

- *Contents:*
  - *Manufacturing System Design* *(4 sessions)*
    - *Problem definition*
    - *Computer Integrated Manufacturing*
    - *Design principles*
    - *A multi-layer model for study of design principles*
    - *Implementing system design concept*

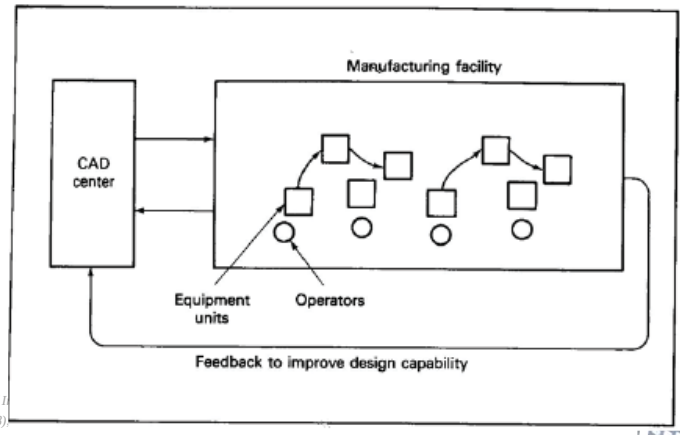
Manufacturing System L

- *A Multilayer Model for the Study of Design Principles*



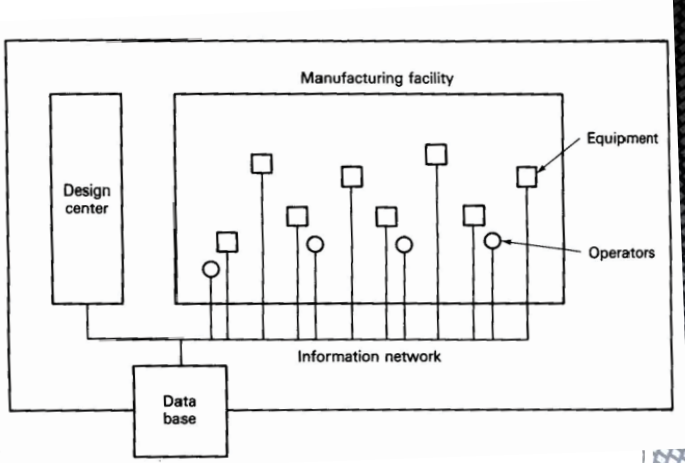
Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Many of the CIM design principles are formulated around the process function and information function aspects of the system (layers 2 and 4 of the multilayer)*
  - *The manufacturing operations include a Computer-Aided Design (CAD) capability that is linked to a CIM facility.*



Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *In the same way that continuous flow manufacturing (CFM) can be taken as a design principle for the process function layer (layer 2), continuous flow information (CFI) can be regarded as a design principle for the information function layer (layer 4).*
  - *The flow of information should be optimized to best achieve performance objectives for the facility*

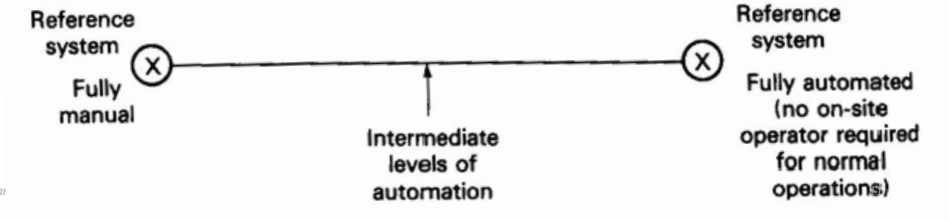


Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *The physical layer (layer l) describes how the process function of layer 2 is implemented in hardware.*
  - *The properties of the used in layer 1 will restrict the range of functional operations and the functional flowcharts will help specify the equipment properties needed for system implementation.*
  - *A close interrelationship thus exists between these two layers.*

Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *For layer 1, important design principles relate to the concepts of fully automated processing equipment and fully automated materials transport equipment.*
    - *These two concepts contribute toward a reference system in which full factory operations can take place without direct human intervention.*
    - *This is a limiting case, as expected for a reference system, that may not be the most appropriate strategy for a given manufacturing system and setting.*

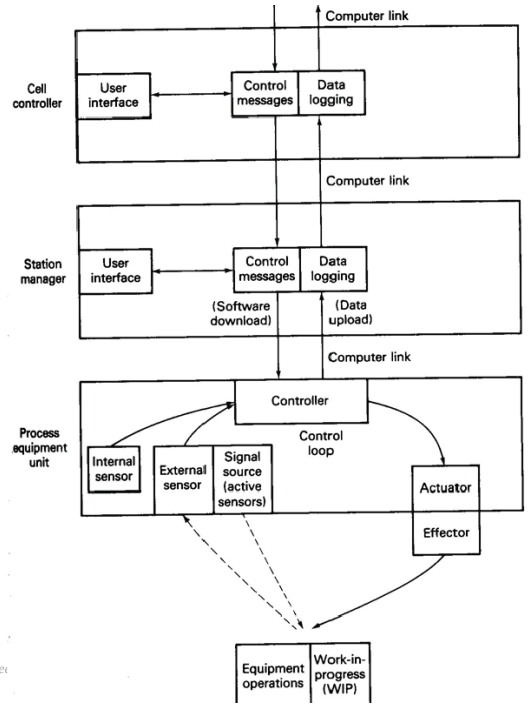


Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *The level of automation should be selected as most appropriate, leading to automation trade-off design (ATD).*
  - *If a manufacturing system is designed around state-of-the-art levels of automation for a given industry, scheduling and cost allowances should be made for tuning up the technology for commercial application.*
  - *The principle of full automation for process and transport equipment is a limiting case or reference system to be used in considering system design.*

Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*



Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Work-in-progress (WIP) must be automatically fed into and out of the station under positive identification and control.*
  - *Optical bar coding is often used to label and identify each item in the assembly process.*
    - *The process equipment station must then be able to complete all transformation processes without direct human intervention.*
    - *This requires that the station be able to receive the WIP from the materials transport subsystem; place the WIP in the correct location, using futuring methods to hold it in place; perform the required operations while ensuring continuous quality control; and transfer the WIP to the materials transport subsystem.*

Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Information can be fed into the equipment station from other locations and information regarding WIP can be communicated back into the computer network.*
    - *A dedicated station manager (associated with the equipment station) can link to a work ceil controller and then to the system wide factory controller.*
  - *If the robots do not make use of closed-loop control systems, they have only rudimentary sensor and control capabilities. The result is a non-adaptable response that severely limits equipment performance.*
    - *As might be expected, ensuring quality production without adequate fixture and process control can be a difficult task. Thus, equipment limitations can restrict the types of flowcharts that are developed for layer 2.*

Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *The elements of the system are internal and or/external sensors, as internalsensors, actuators to drive effectors, which then act on the product, and a controller that links sensors to the actuators/effectors.*
  - *An alternative approach is to make use of external sensors that can gather information from the equipment operations and work-in Progress on an ongoing basis and to link these external sensors through the controller to the actuator and effector.*
    - *Passive sensors make use of sensory information that is available in the environment, and active sensors require a signal source to produce the desired sensor input.*