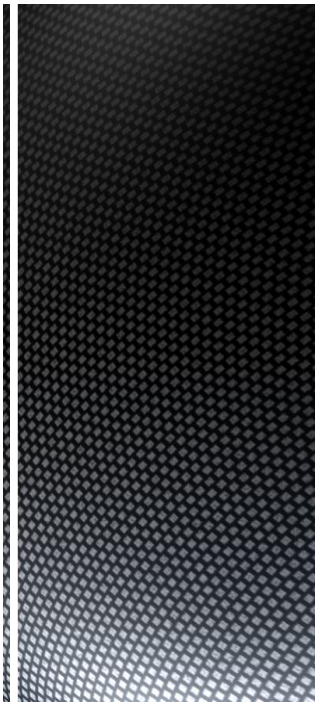


CIM (21-548)

Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

Session # 11

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 Design

- *A Multilayer Model for the Study of Design Principles*
  - *The design principles in use today reflect a combination of historical experience and theoretical constructs that seem to be generalizable to a wide range of systems.*
  - *The resultant reference systems can be based on the specific activities of several enterprises and their learning conclusions, or on seemingly attractive constructs resulting from theoretical analysis and modeling, or from a combination of both resources.*

Manufacturing System Design

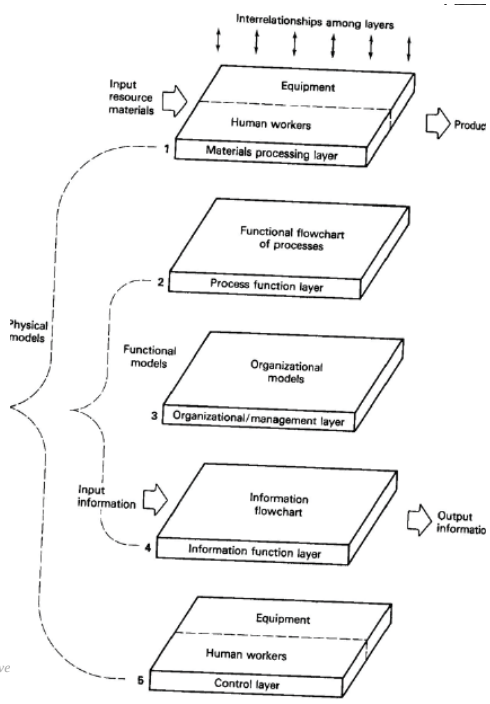
- *A Multilayer Model for the Study of Design Principles*
  - *Design principles often emphasize a particular aspect of a system, resulting in a reference system that does not reflect the full complexity of a to-be system.*
  - *In applying such principles, it is important to avoid building a one-dimensional system and a single-reference concept.*
    - *The mechanism of application must still emphasize an integrated systems approach for to-be system design.*

Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *The model expands on the three perspectives for viewing a system to create a five-layer model.*
  - *Each layer provides a different way of describing the system.*
    - *Strong interrelationships exist among the layers, ensuring that they provide complementary descriptions of the same system.*

Manufacturing System Design

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



Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Viewing the manufacturing system, an observer will see equipment and human workers that are transforming input resources into a product (layer 1),*
  - *and equipment and human workers that are providing the required control activities to operate the resource processing system (layer 5).*
  - *The equipment and workers in layer I process the resources by direct contact, where as the equipment and workers in layer 5 are not in direct contact with resource processing but function in a supporting and supervisory capacity.*
  - *Control is exerted by having layer 5 provide information to and direct the processing workers or operating equipment (layer 1).*
  - *Together layers I and 5 constitute the observable portion of the manufacturing system and determine the performance boundaries associated with the system.*

Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Layers 1 and 5 describe the observable part of the system and determine the physical constraints on the manufacturing activities.*
  - *However, the intelligence of the system, although not visible, is clearly a crucial aspect of facility operation.*
  - *Layer 2 may be thought of as a functional flowchart of the processes being performed by layer 1.*
  - *Layer 2 describes how the processes of layer 1 must relate to one another to transform the input resources to the desired product.*
  - *Layer 2 is thus a functional model of the desired processes, whereas layer I is the visible implementation of the related activities.*

Manufacturing System Design

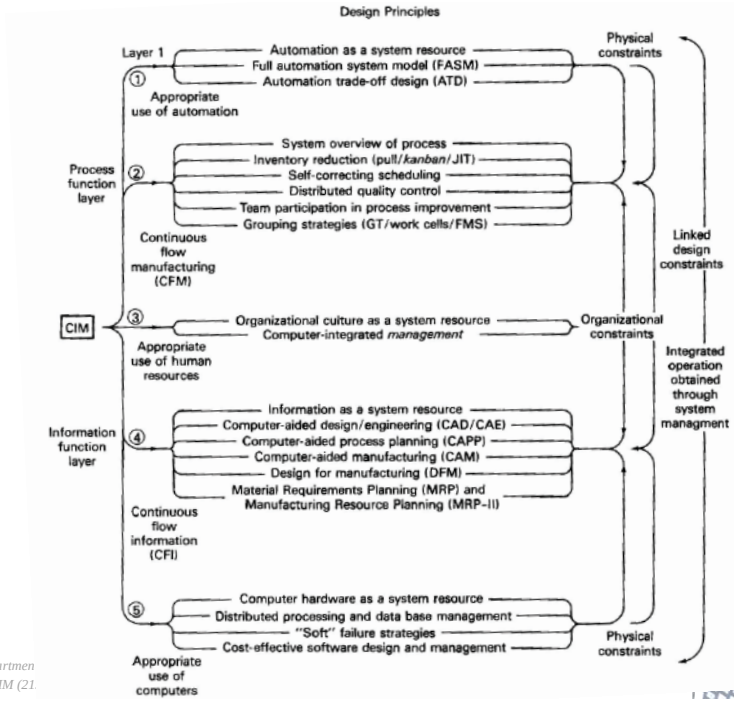
- *A Multilayer Model for the Study of Design Principles*
  - *Where layer 5 includes the physical equipment and human workers used to control the materials processing activity, layer 4 may be thought of as an information control flowchart for the system.*
  - *Where layer 2 describes the process functions necessary to manufacture a desired product, layer 4 describes the information flow that must exist to direct the desired process combination.*
  - *Layers 1 and 5 provide a complete description of the observable system; layers 2 and 4 provide a complete model of the functions and information that form the system knowledge base.*

Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *For all manufacturing settings, the activities of workers depend on human behavior characteristics and on the organizational/management structure for the facility (layer 3).*
  - *This structure is also a non observable determinant of behavior but is of critical importance in system operation. Unless the organizational/management layer matched to the defined system, worker activities may not be consistent with the desired flowchart models.*

Manufacturing System Design

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



Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *The five-layer model can provide a useful entry into the internal study and design of manufacturing systems.*
  - *The model provides a representation that can be used to examine the system from several perspectives and to identify some of the layer trade-offs and areas of complication that can be encountered.*