

## *CIM (21-548)*

*Advanced Manufacturing Laboratory  
Department of Industrial Engineering  
Sharif University of Technology*

*Session # 12*



## *Course Description*

### ▪ *Instructor*

- *Omid Fatahi Valilai, Ph.D. Industrial Engineering Department, Sharif University of Technology*
- *Email: [FValilai@sharif.edu](mailto:FValilai@sharif.edu), Tel: 6616-5706*
- *Website: [Sharif.edu/~fvalilai](http://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: 16<sup>th</sup> Azar 1393, 09:00 ~ 10:30
- **Final Exam:**
  - Tuesday: 30<sup>th</sup> 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

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## 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)

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## Course Description (Continued..)

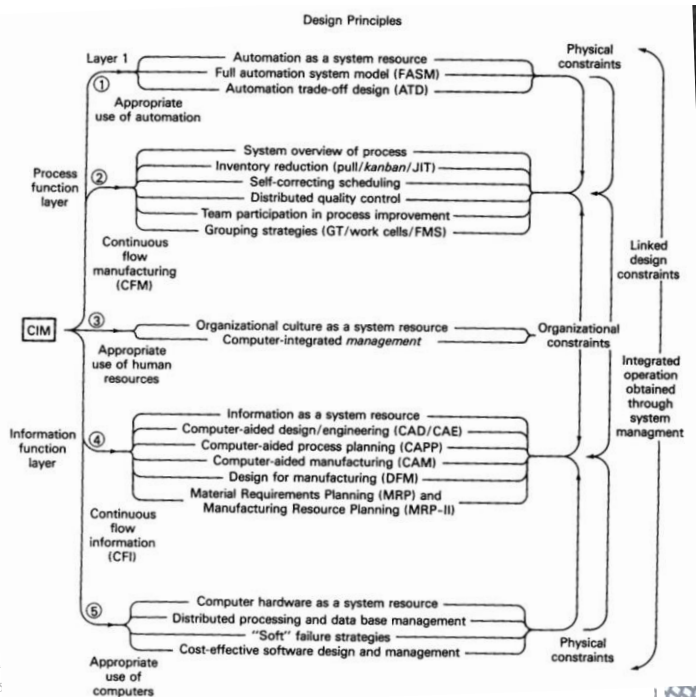
▪ **Contents:**

- *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*

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## Manufacturing System I

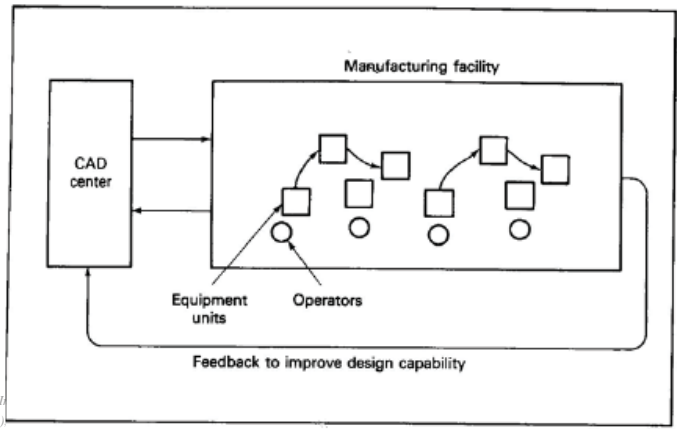
- *A Multilayer Model for the Study of Design Principles*



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## Manufacturing System Design

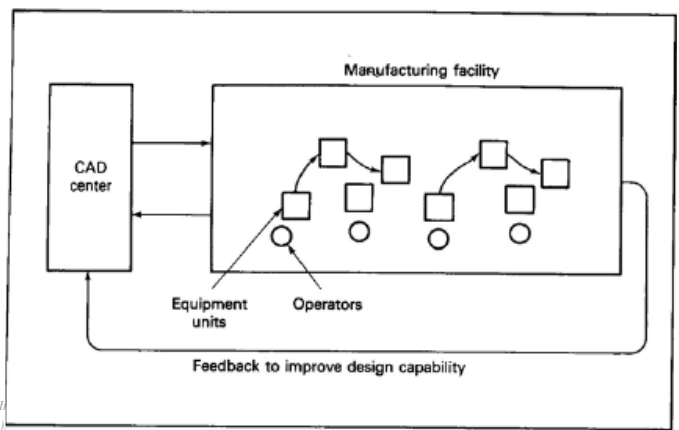
- A Multilayer Model for the Study of Design Principles
  - Many of the CIM design principles are formulated around the process function and information function aspects of the system (layers 2 and 4 of the multilayer)
  - The manufacturing operations include a Computer-Aided Design (CAD) capability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



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## Manufacturing System Design

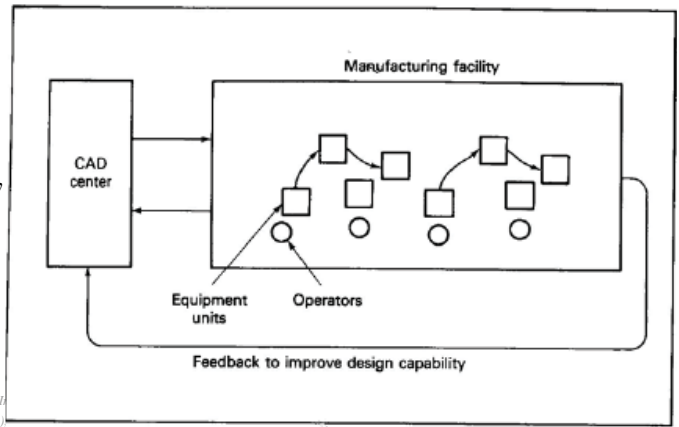
- A Multilayer Model for the Study of Design Principles
  - One of more or less obvious issues in facility design is to decide how various processing stations can be linked most effectively.
  - Simple concepts can have widespread impact on manufacturing system design and operation



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## Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Looking at the facility in overview, continuous flow manufacturing (CFM) has been suggested as an appropriate emphasis.*
  - *An effort should be made to optimize the relationships among all tasks in the facility in order to maximize all value-added activities and remove all non-value-added activities.*



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## Exercise: CM:I:08

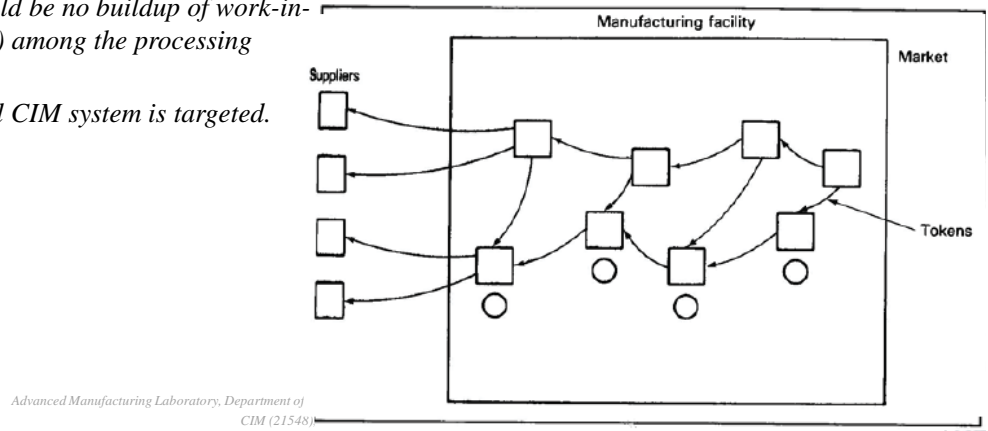
- *Developing Models of Manufacturing Systems*
  - *The advantages of using short cycle time manufacturing (SCM) instead of continuous flow manufacturing (CFM)*
    - *Martin, D.P. ;*
    - *Published in: Advanced Semiconductor Manufacturing Conference and Workshop, 1998. 1998 IEEE/SEMI*
    - *DOI: 10.1109/ASMC.1998.731385*

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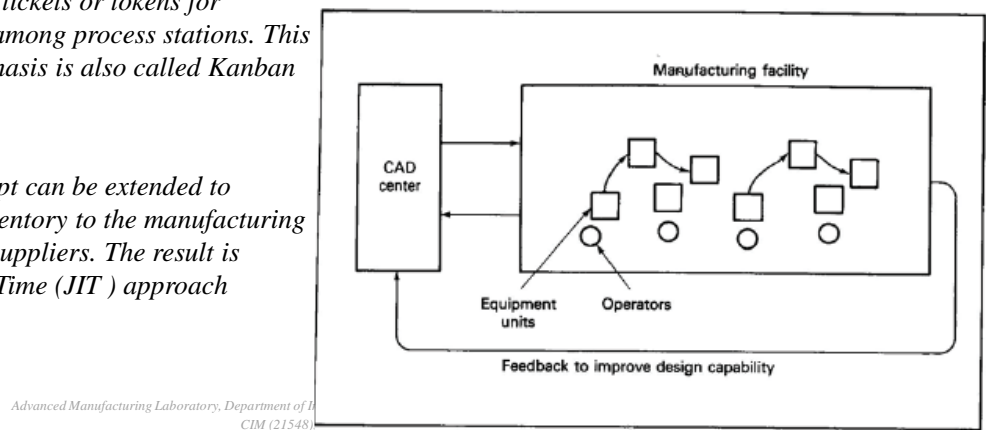
## Manufacturing System Design

- A Multilayer Model for the Study of Design Principles
  - One implication of the CFM principle is that there should be no buildup of work-in-progress (WIP) among the processing stations.
  - A pull-oriented CIM system is targeted.



## Manufacturing System Design

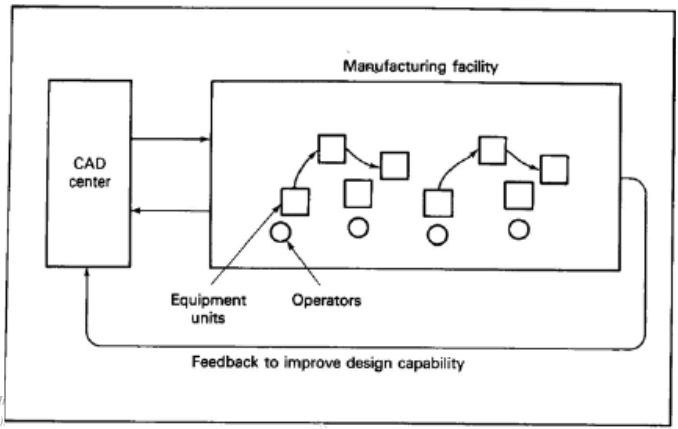
- A Multilayer Model for the Study of Design Principles
  - The production process can be controlled by using a series of tickets or tokens for communication among process stations. This type of pull emphasis is also called Kanban
  - This same concept can be extended to control input inventory to the manufacturing system from all suppliers. The result is called a Just-in-Time (JIT) approach



## Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *If the to-be system design includes transition stages toward CFM and a pull system, then a major learning program will be required.*
  - *The transition stages can involve a gradual reduction in the effective number of tickets in circulation, forcing a search and learn activity to improve process efficiency and flow.*

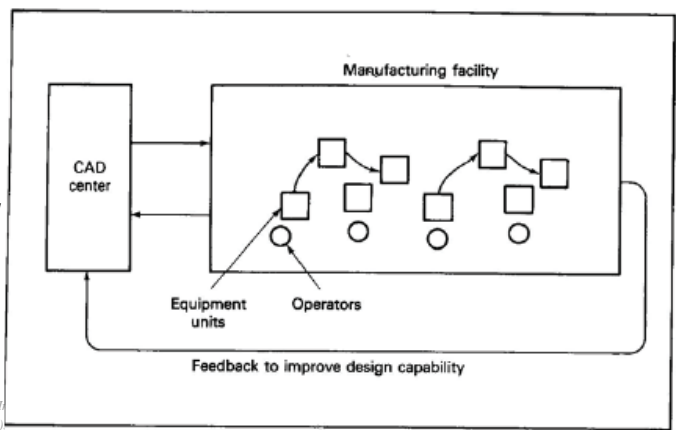
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## Manufacturing System Design

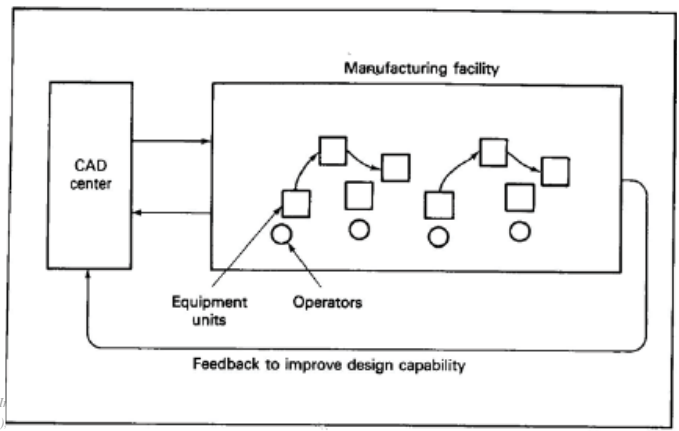
- *A Multilayer Model for the Study of Design Principles*
  - *A complex monitoring process must be in place, and a self-correcting scheduling system is required.*
  - *The CFM concept requires active operator/worker participation in producing a process flow that is optimized at each station and throughout the facility, combined with system-oriented leadership by managers.*

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## Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *CFM thus appears to be a reasonable design principle, but one that can be difficult to implement.*
  - *The requirements for system over view, coordination, high quality levels, and close teamwork may not be compatible with equipment capabilities (constraints from layer I ) or with the existing organizational/management structure (layer 3).*



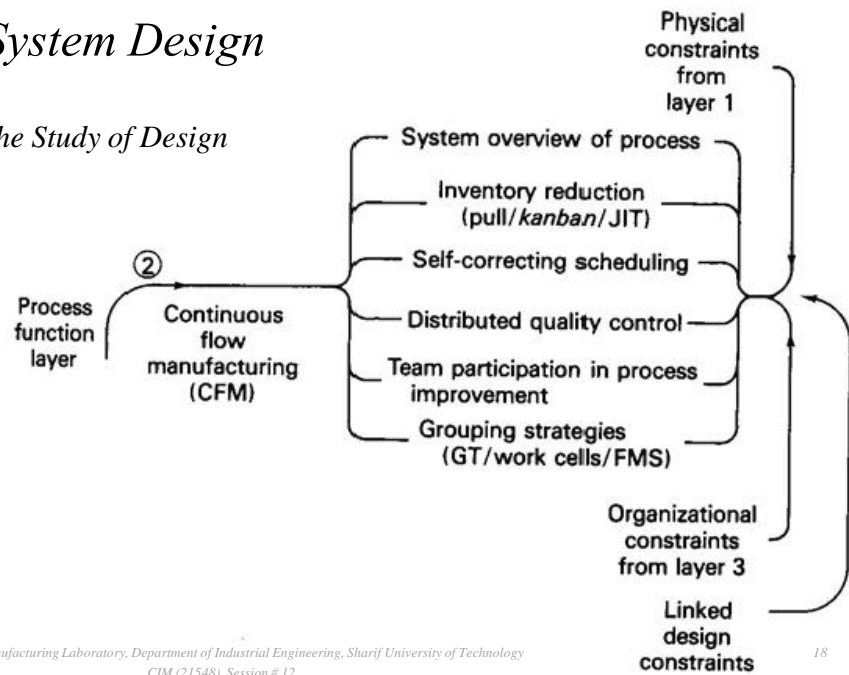
## Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *A reasonable question is how the various equipment stations should be functionally related to one another.*
  - *The functional relationships among equipment units are often achieved by:*
    - *(1) placing units where they would "fit" (drawing on the physical constraints of layer I to determine placement);*
    - *(2) grouping by class or type of equipment; or*
    - *(3) grouping to achieve a linear assembly-line flow.*



## Manufacturing System Design

- A Multilayer Model for the Study of Design Principles



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