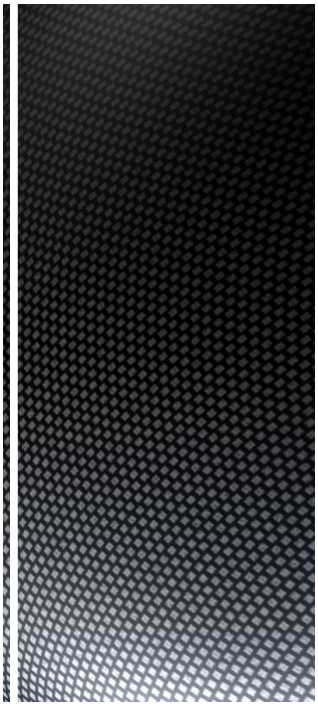


CIM (21-548)

Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

Session # 13

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..)*

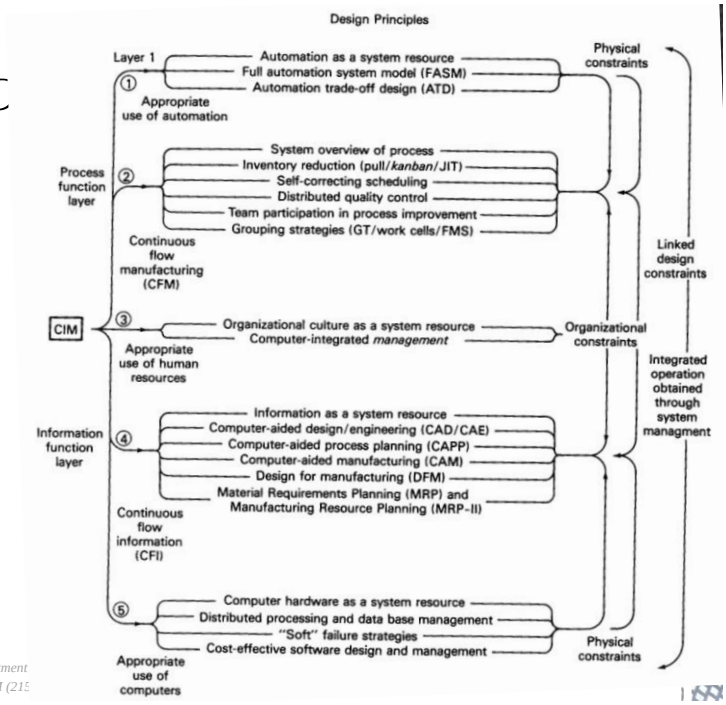
- *Contents:*
  - *Globalization and Manufacturing Paradigms* *(8 sessions)*
  - *System Concepts* *(3 sessions)*
  - *Evolution of Manufacturing systems* *(2 sessions)*
  - *Manufacturing System Design* *(4 sessions)*
  - *Manufacturing Equipment Design* *(3 sessions)*
  - *Information flow in Manufacturing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

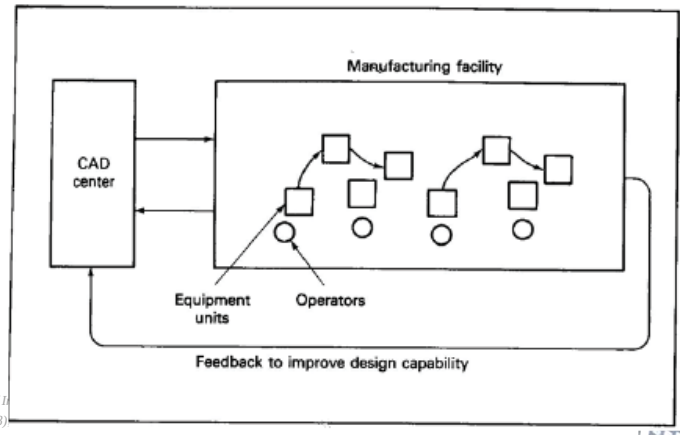
Manufacturing System L

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



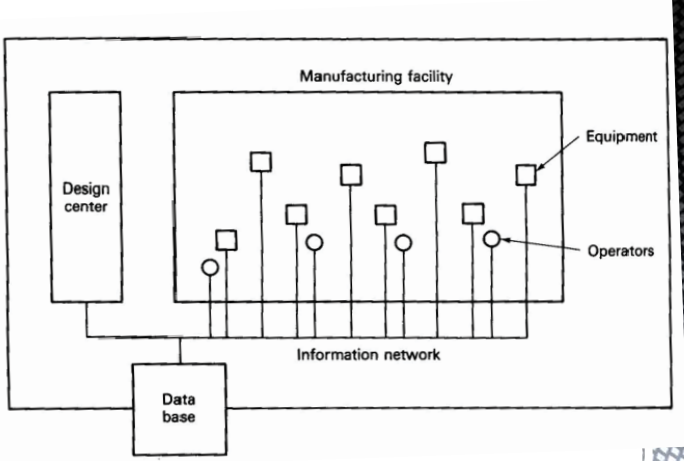
Manufacturing System Design

- *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.*



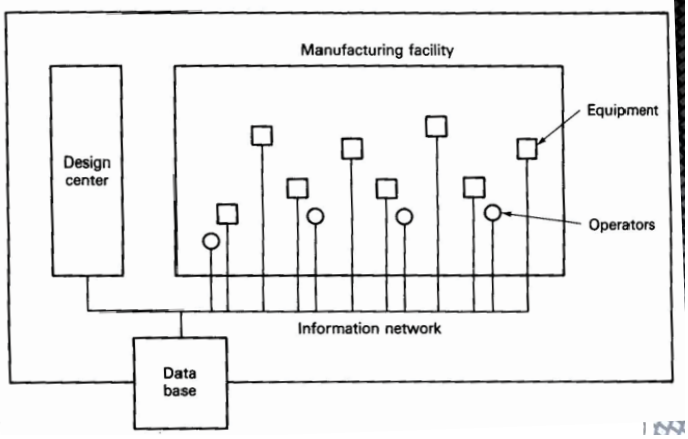
Manufacturing System Design

- *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*



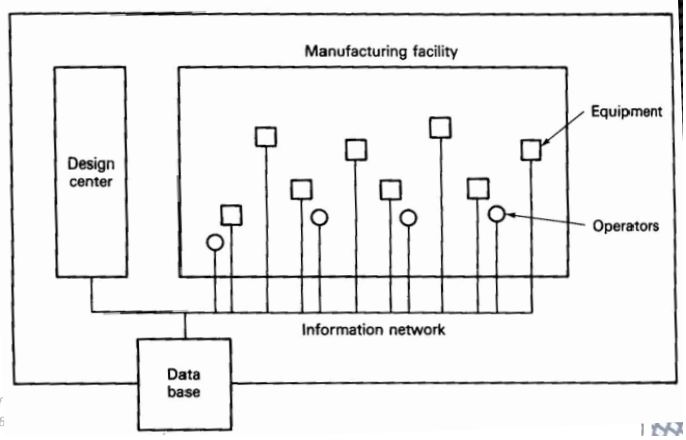
Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *The objective is to treat information as a manufacturing resource, to be handled as appropriately as possible.*
  - *Duplication should be minimized, access provided to all who need it, and costs reduced as much as possible.*
  - *It has been estimated that more than 50 percent of the costs of a manufacturing facility can be associated with an information overhead.*



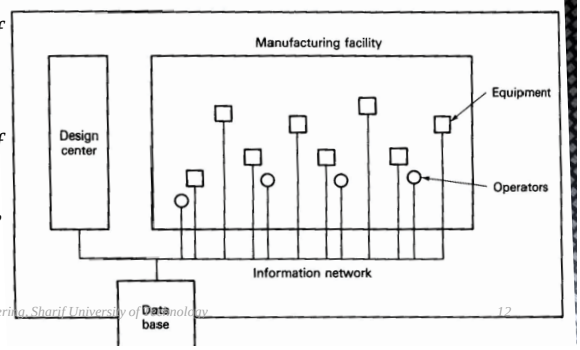
Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Successful application of the CFI design principle (layer 4) will depend on the willingness of the organization (layer 3) to evolve in significant ways, combined with*
  - *An understanding of the principal implementation constraints (layer 5).*
  - *CFI implies the integration of the information flow, the use of computer networks, and a common computerized data base.*



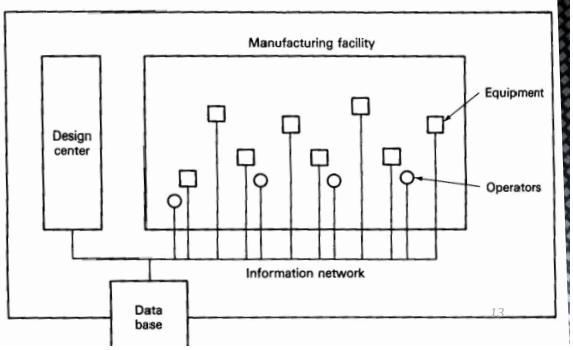
Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *The information layer encompasses the entire product design manufacturing cycle, including information flow related to system management.*
  - *The information flow is the major unifying aspect of the system.*
  - *Part of this information flow will be data from all of t he computer aided activities taking place, as related to design , process planning, manufacturing, and feedback from the manufacturing system.*



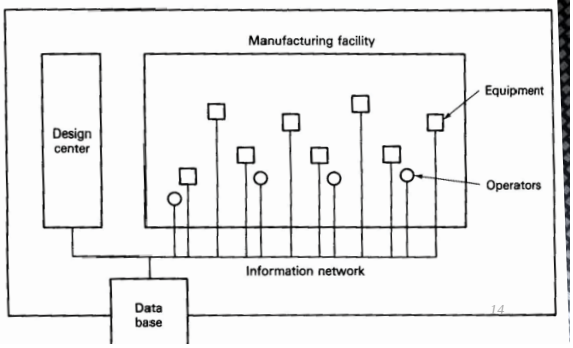
Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *In addition, a continuous information flow must take place between the management sector and .the factory.*
  - *Management decision making regarding factory operations must be continually passed to the factory, and data regarding factory performance must be passed back to management.*
  - *The design, management, and manufacturing sectors of the system must be linked by a continuous information exchange that enables each part of the system to function effectively as part of the whole.*



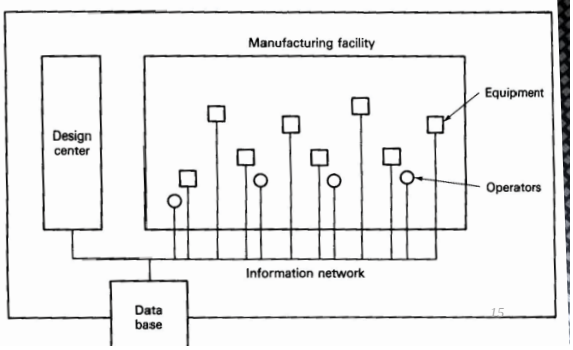
Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Computer-aided design (CAD) and computer-aided engineering (CAE) are used to improve the creation of product design information and the flow of information from design to manufacturing.*
  - *CAD involves the use of computers to support the design activity. In typical settings, products are designed through use of a graphics terminal.*
  - *The designer can modify the proposed geometry and study the changes as they appear in the screen of the terminal.*



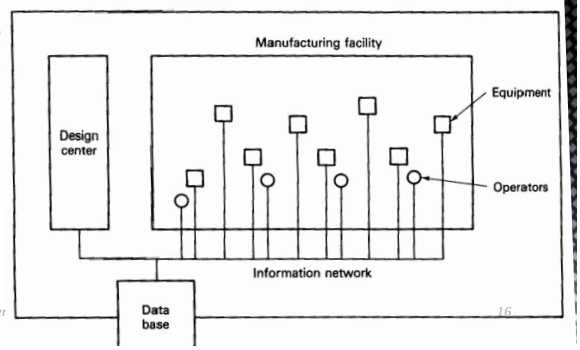
Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Computer-aided engineering (CAE) can be used to strengthen CAD by linking the geometric design process with modeling and simulation tools that can predict how a given product design will actually function.*
  - *The models use the geometric design and materials specifications to explore how such a product would actually perform.*
  - *An important design aid, CAE is widely used for both mechanical and electronics products.*



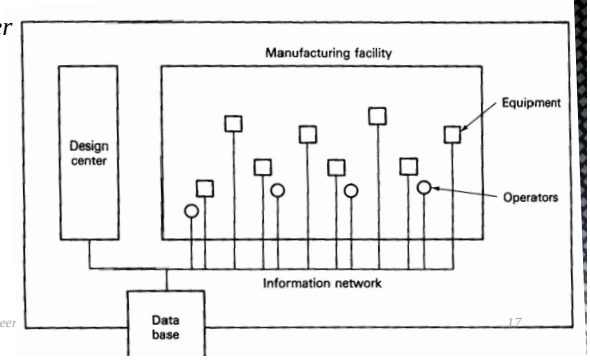
Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Computer-aided process planning (CAPP) uses computer capability to help plan an optimized process flow to manufacture a specific product.*
  - *The information capability of layer 4 can be used to help design the process flow of layer 2. In a reciprocal sense, the selected process flow configuration of layer 2 (implementing CFM concepts) will help determine the required information flow (implementing CFI concepts) of layer 4.*



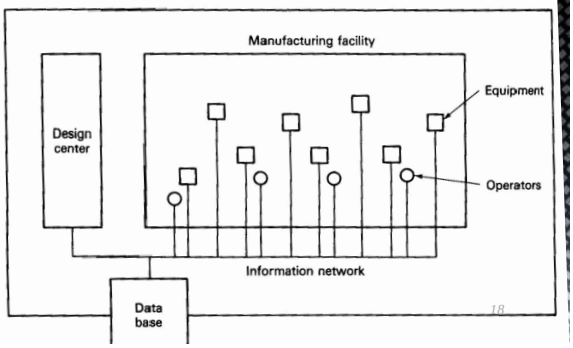
Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Computer-aided manufacturing (CAM) involves the use of computers to plan and conduct the production of a product.*
  - *Computers can bused to collect and process data (layer 4), control the manufacturing process (layer 5), and provide decision-making information (for layer 3).*
  - *CAM thus involves using computer information-handling capabilities associated with CFI to achieve the functional objectives expressed for CFM.*



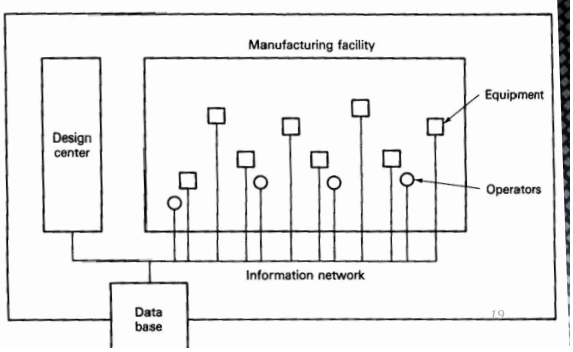
Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *The design for manufacturing (DFM) concept combines CAD/ CAE/C PP/CAM in order to customize the product design process for the part1cular manufacturing facility.*
  - *The capabilities of the manufacturing system are modeled and fed back into the design activity in order to produce product designs that are most effective for the available manufacturing system, thereby maximizing effective facility use and minimizing product development costs.*



Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Information flow must also be used to support management operations and decision making.*
  - *The MRP (Material Requirements Planning) and MRP-II (Manufacturing Resource Planning) software systems support this purpose.*
  - *A manufacturing data base links schedules bills of material, and inventory data in order to make the most effective use of the CFM system.*



Manufacturing System Design

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