**Automation (21-541)**
Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

Session # 3

**Session Schedule**

- CIM hardware and software considerations
Introduction to manufacturing automation and CIM (Computer Integrated Manufacturing)

- Automation:
  - set of all measures aiming at replacing human work through machines
    (e.g. automation is applied science)
  - the technology used for this purpose
    (e.g. this company has an automation department)

- Automation:
  - replacement of human work through machines
    (e.g. the automatisation of the textile factory caused uproar of the workers)
  - replacement of conscious activity by reflexes
    (e.g. drill of the sailors allows the automatisation of ship handling)

- Automation:
  - The use of computers and machines instead of people to do a job

CIM history (Continued...)

- CIM scope within the enterprises:
  - Marketing
  - Product Design
  - Planning
  - Purchase
  - Manufacturing Engineering
  - Factory Automation Hardware
  - Warehousing
  - Logistics and Supply Chain Management
  - Finance
  - Information Management
CIM hardware and software considerations

- **CIM equipment:**
  - CNC machines
  - Computerized work centers
  - Robotic work cells
  - DNC/FMS systems
  - Work handling and tool handling devices
  - Storage devices
  - Sensors, shop floor data collection devices
  - Inspection machines
  - Computers, controllers
  - CAD/CAM systems, workstations / terminals, data entry terminals, bar code readers, RFID tags
  - Printers, plotters and other peripheral devices, modems, cables, connectors

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CIM software comprises computer programs like:

- Management Information System; Database Management
- Sales, Order Entry
- Marketing
- Finance
- Analysis; Modeling and Design
- Simulation
- Inventory Control; Materials Handling
- Monitoring; Shop Floor Data Collection
- Process Planning
- Manufacturing Facilities Planning; Production Control
- Work Flow Automation
- Quality Management
Introduction to manufacturing automation and CIM (Computer Integrated Manufacturing)

- Computer Integrated Manufacturing (CIM) encompasses
  - The entire range of product development and manufacturing activities with all the functions being carried out
  - With the help of dedicated software packages.
  - The data required for various functions are passed from one application software to another in a seamless manner
- CIM considers
  - All activities from the design of the product to customer support in an integrated way.

CIM Database management

- The information required for manufacturing cover a wide range of disciplines and serving a multitude of inter-related yet vastly differing needs.

- A database can be defined as a collection of data in a single location designed to be used by different programmers for a variety of applications.

- A database is a collection of logically related data stored together in a set of files intended to serve one or more applications in an optimal fashion.

- Database must also have a predetermined structure and organization suitable for access, interpretation, or processing either manually or automatically.
**CIM Database management**

- **The CIM database comprises basically four classes of data:**
  - **Product Data:** Data about parts to be manufactured. It includes text and geometry data.
  - **Manufacturing Data:** The information as to how the parts are to be manufactured is available in production data.
  - **Operational Data:** Closely related to manufacturing data but describes the things specific to production, such as lot size, schedule, assembly sequence, qualification scheme.
  - **Resource Data:** This is closely related to operational data but describes the resources involved in operations, such as materials, machines, human resources and money.

**CIM Database management**

- **Varied tasks one might expect to accomplish in a CIM environment:**
  - Designing assemblies and performing tolerance analysis on those assemblies.
  - Preparing production drawings of assemblies, individual parts, tooling, fixtures and other manufacturing facilities.
  - Preparing part lists and bill of materials (BOM).
  - Preparing process plans for individual part manufacture and assembly.
  - Programming CNC machines for processing complete parts (CAM).
  - Designing work cells and programming the movement of components in those cells using work handling devices like robots, conveyors, AGV’s/RGV’s.
  - Preparing inspection programs including programs for CNC machines.
Make your own CIM database !!

- To understand the necessities of a CIM data base:
  - Groups with 5-6 students will be established

- Each group starts the essential activities for forming a CIM database in the class theoretically

- The implementation of theoretical activities will be conducted during the weeks in manufacturing laboratory

- The implementation results will form the groups CIM databases during the course

Make your own CIM database !!

- First step:
  - Definition of the groups
    - You can introduce your group members:

- You will be assigned to random defined groups.
**Make your own CIM database !!**

- **Second step:**
  - Choose a programming language e.g.
    - Microsoft SQL server
    - Oracle
    - Microsoft Access
    - Visual studio
    - C++
    - C
    - Pascal

- **Third step:**
  - Theoretically plan the procedures which enable:
    - The storage of object related data (attributes)
    - The sort of data related to an array of objects (Tables, Primary keys)
    - The storage of relation among related objects (relational database, Foreign keys)
    - The retrieve operation of a definite object by means of its attributes (Select)
    - The modification/delete operation of a definite object by means of its attributes (Update/Delete)
Make your own CIM database !!

- **Third step: (Continued ...)**
  - **Theoretically plan the procedures which enable:**
    - The transfer of your data base from one computer to another (Back up operation)
  - The extract of information from an array objects (Information)
  - The extract of knowledge from a series of information (knowledge)