

# *Automation (21-541)*

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

*Session # 5*



## *Session Schedule*

- *Product lifecycle management (PLM) from automation and CIM perspective*
  - *Automation & CIM role in Product development*
    - *Product development cycle*
    - *Concurrent engineering and automation & CIM considerations*

## *Introduction to manufacturing automation and CIM (Computer Integrated Manufacturing)*

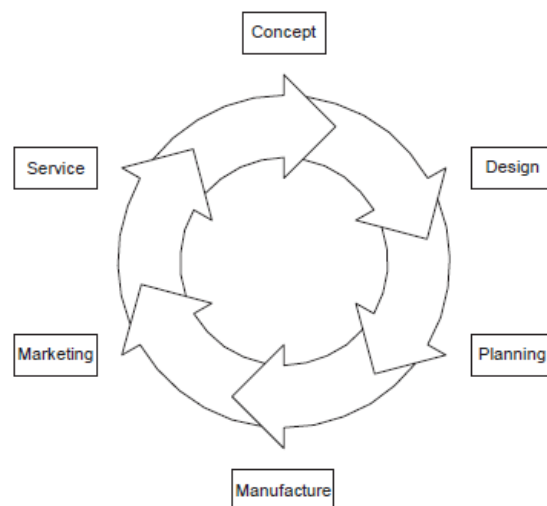
- **Automation:**
  - *Set of all measures aiming at replacing human work through machines (e.g. automation is applied science)*
  - *the technology used for this purpose (e.g. this company has an automation department)*
- **Automation:**
  - *Replacement of human work through machines (e.g. the automatisisation of the textile factory caused uproar of the workers)*
  - *Replacement of conscious activity by reflexes (e.g. drill of the sailors allows the automatisisation of ship handling)*
- **Automation:**
  - *The use of computers and machines instead of people to do a job*

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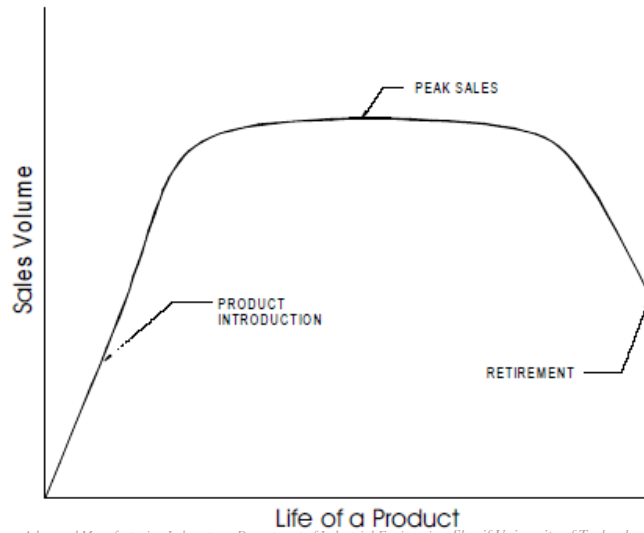
## *Product lifecycle management (PLM)*



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## Product lifecycle management (PLM)



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## Product lifecycle management (PLM)

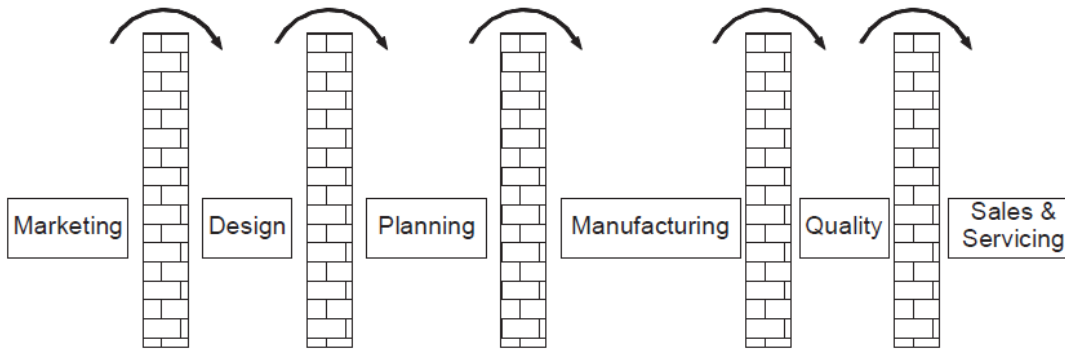
- *Sequential Engineering:*
  - *The traditional product development process at the prototype development stage is sequential.*
  - *It includes*
    - *Product design,*
    - *Development of manufacturing process and*
    - *Supporting quality and testing activities*
  - *Which are all carried out one after another.*

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## Product lifecycle management (PLM)

- Sequential Engineering is often called “across the wall”:



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## Product lifecycle management (PLM)

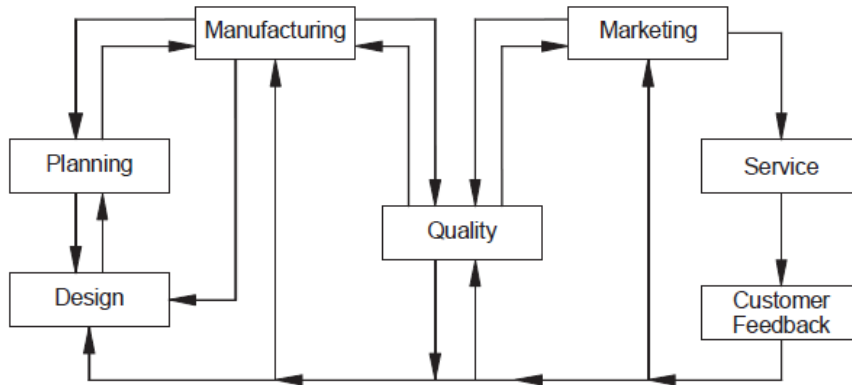
- Sequential Engineering discussions:
  - Changes in design may be called for when the manufacturing department is unable to meet design specifications or there are problems in assembly.
  - This will lead to inevitable conflicts, each department sticking to their own decisions and may often require intervention of senior management to resolve conflicts or differences in opinion.
  - Time taken to product development is usually more than what is anticipated and correspondingly the response to the market requirements will be slow compared to a competing company.

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## Product lifecycle management (PLM)

### Sequential Engineering discussions:



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## Product lifecycle management (PLM)

### Concurrent Engineering:

- Concurrent engineering or Simultaneous Engineering is a methodology of restructuring the product development activity in a manufacturing organization
- This is accomplished through using a cross functional team approach and is a technique adopted to improve the efficiency of product design and reduce the product development cycle time.
- Concurrent engineering is also sometimes referred to as Parallel Engineering.
- Concurrent Engineering brings together a wide spectrum of people from several functional areas in the design and manufacture of a product.

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## *Product lifecycle management (PLM)*

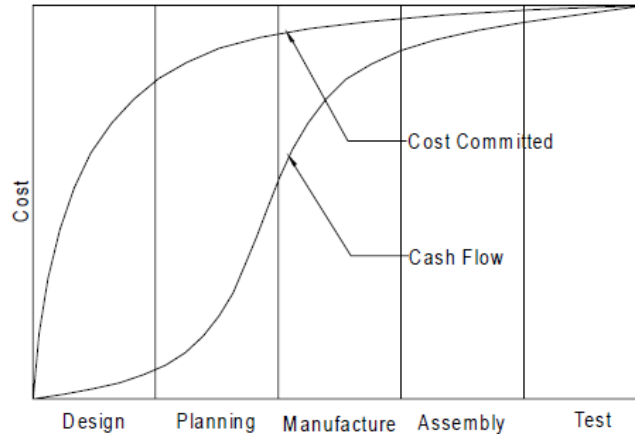
- *Concurrent Engineering:*
  - *In CE everyone interacts with each other from the start, and they perform their tasks in parallel.*
  - *The team reviews the design from the point of view of marketing, process, tool design and procurement, operation, facility and capacity planning, design for manufacturability, assembly, testing and maintenance, standardization, procurement of components and sub-assemblies, quality assurance, ... .*
  - *Any possible bottleneck in the development process is thoroughly studied and rectified.*

## *Product lifecycle management (PLM)*

- *Concurrent Engineering:*
  - *CE gives marketing and other groups the opportunity to review the design during the modeling, prototyping and soft tooling phases of development.*
  - *CAD systems especially 3D modelers can play an important role in early product development phases.*
  - *CE enables the co-operation between various specialists and systematic application of special methods such as QFD (Quality Function Deployment), DFMA (Design for Manufacture and Assembly) and FMEA (Failure Mode and Effect Analysis) ensures quick optimization of design and early detection of possible faults in product and production planning.*

## Product lifecycle management (PLM)

### ▪ Concurrent Engineering:



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## Product lifecycle management (PLM)

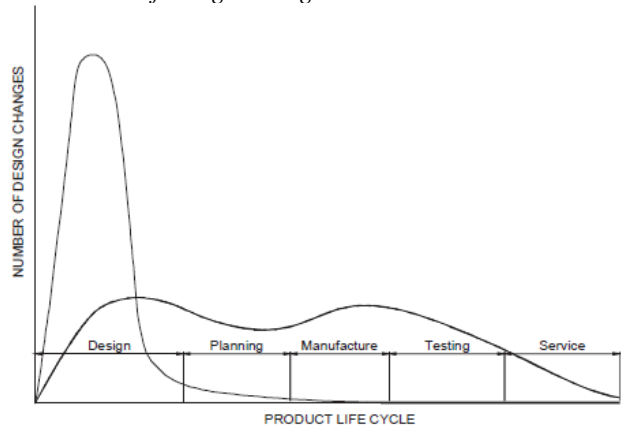
- *Concurrent Engineering merits:*
  - *Reduction in the number of design changes*
  - *Cost of changes in design*
  - *Holistic approach to product development*
  - *Robust products*
  - *Reduction in lead time for product development*

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## Product lifecycle management (PLM)

- Concurrent Engineering merits:
  - Reduction in the number of design changes

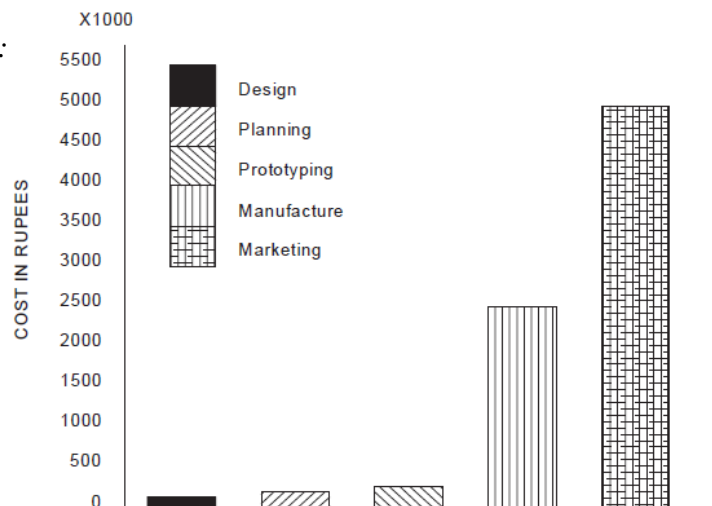


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## Product lifecycle management (PLM)

- Concurrent Engineering merits:
  - Cost of changes in design



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## *Product lifecycle management (PLM)*

- *Concurrent Engineering merits:*
    - *Holistic approach to product development*
      - *In CE, no longer product development is considered the exclusive activity of the design department.*
    - *Participation of*
      - *Planning,*
      - *Manufacturing,*
      - *Quality,*
      - *Service,*
      - *Vendor development and*
      - *Marketing personnel*
- in the development process enables the cross functional team to view the development as a total responsibility and this results in better communication among the various departments.*

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## *Product lifecycle management (PLM)*

- *Concurrent Engineering merits:*
  - *Robust products*
    - *Concurrent approach to product design results in products with fewer errors*
    - *It avoids the loss of goodwill of the customers due to poorly engineered products*
    - *The entire product development team looks at each and every aspect of products – cost, specifications, aesthetics, ergonomics, performance and maintainability.*
    - *The resulting product will naturally satisfy the customer.*

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## *Product lifecycle management (PLM)*

- *Concurrent Engineering merits:*
  - *Reduction in lead time for product development*
    - *Time compression in product development is an important issue today.*
  - *Concurrent engineering reduces the product development time significantly as the preparatory work in all downstream functions can take place concurrently with design.*
  - *Elimination of the errors in design appreciably reduces the possibility of time overrun, enabling the development schedule to be maintained.*

## *Product lifecycle management (PLM)*

- *Concurrent Engineering implementation via CIM:*
  - *Concurrent (Simultaneous) Engineering is an orthogonal concept that defines how concurrent and simultaneous work flows are organized and the information flow, storage, retrieval and decision making can be supported and controlled.*
  - *Information Technology(IT) is the backbone of CE.*
  - *Software tools are available today to perform all the manufacturing related activities.*
  - *CIM tries to permit almost seamless transfer of data from one application to another.*

## *Product lifecycle management (PLM)*

- *Concurrent Engineering implementation via CIM:*
  - *In every phase of the product development, from concept to final design, sufficient information has to be provided to the product development team*
  
  - *The members of the team need to take the right decisions with respect to*
    - *production,*
    - *production planning and*
    - *product support.*
  
  - *Special attention has to be given to the adoption of new production technologies and to take make or buy decisions including the early integration of the suppliers into the development process.*

## *Product lifecycle management (PLM)*

- *Concurrent Engineering implementation via CIM:*
  - *Through CIM concept, information systems have to be developed which integrate the different engineering disciplines*
  
  - *CIM moreover integrates the various engineering support tools, promoting and pushing a conversion of the currently practiced sequential work flow into a more concurrent work flow*
    - *with a higher degree of parallelism to shorten the product development lead-time.*