School of Mechanical Engineering

Course Code : MCDM5004 **Course Name: Product Design and Life cycle Management**

UNIT IV

Producibility and Reliability

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PRODUCIBILITY STRATEGIES AND SIMPLIFICATION

Producibility Strategies

- Producibility needs to be an integral element of the design process, with close coordination between the production and design.
- Producibility requirements and forming design teams with production, support areas, and vendor representative's foster integration of producibility factors in the design.
- The design is continuously evaluated to ensure that the producibility and supportability requirements are met.
- Vendors are included at every step to ensure high quality parts and on time delivery.

SIMPLIFICATION: COMMONALITY AND PREFERRED METHODS

- Simplifying a product can have a greater positive effect on cost, quality, producibility, reliability. availability, logistics and even aesthetics than any other technique.
- A simple or common design is easier to design, manufacture, and support than a more complex design.
- A simple design has fewer parts and options, is easier to build, operate and repair, and requires less non-value added processes.
- A common design is similar enough to a current product to allow the efficient reuse of designs, parts.

Best practices

- Simplification is a Major Goal of Product Development
- Keep It Simple - KISS and Complexity Analysis
- Limit Number of Customer Options, Features
- Product Platforms, Lines and Families
- Modularity and Scalability
- Part, Process and Vendor Reduction
- Re-engineer or Eliminate Non-Value Added Tasks
- Part Families and Group Technology
- Function Analysis and Value Engineering

- Ergonomics and Human Engineering
- Mistake Proofing and Poka Yoke
- Minimize Requirements and Effects of Variability
- Reduce Technical Risks
- Common, Standard, and Reusable Designs
- Standard or Preferred Part, Software and Vendor Lists

Important definitions

- Design simplification is a design technique that reduces the number or complexity of manufacturing and support opportunities such as the number of tasks required or the probability of problems.
- The metrics of simplification are based on the concept that a design's complexity is a function of three aspects:

1. Number of opportunities (measured by number of parts, features, lines of software code, operator options)

2. Level of difficulty for meeting each opportunity (measured by level of tolerances, tolerance fits, software timing, operator training, shipping requirements etc.)

3. Technical risk or unpredictability (measured by number of new or unproven processes, parts, vendors, software modules, or users)

Best practices

- Keeping it simple - K.I.S.S. and complexity analysis simplifies the design and its support system.
- Limit number of customer options or features (i.e., features and permutations) to reduce complexity.
- Limit number of international permutations to reduce the number of manufacturing and service tasks
- Product Platforms, Lines and Families capitalize on manufacturing similarities to decrease manufacturing and support errors and costs
- Modularity divides complex systems into separate modules having defined interfaces to simplify manufacturing, testing, repair, logistic and maintenance tasks.

- Scalability allows systems or products to be developed or enlarged by combining modules or duplicating designs.
- Part reduction includes deleting unnecessary parts, combining parts or designs, and reducing the number of different parts by standardizing common parts.
- Process and vendor reduction reduces complexity.
- Re-engineering is used to eliminate non-value added tasks.
- Part families and group technology also capitalize on manufacturing similarities to decrease manufacturing errors and costs.
- Function analysis and value engineering identify a simpler design that can perform the same functions.

- Minimize manufacturing requirements and the effects of variability using tolerance analysis, robust design, and six sigma quality.
- Human engineering and error reduction techniques reduce the total number of human error opportunities and the chance of these errors occurring.
- Reduce technical risks by using proven technologies, manufacturing processes, vendors, and software products.
- Commonality uses proven designs, software modules, parts, materials, and vendors to reduce risks, costs, etc.
- Minimize manufacturing requirements and the effects of variability using tolerance analysis, robust design, and six sigma quality

References

1. John W. Priest and Jose M. Sanchez (2001), Product development and design for manufacturing- A collaborative approach to produciability and reliability, Marcel Dekker Publications, ISBN- 978-0-824-79935-9.
2. Karl T. Ulrich and Steven D. Eppinger (2009), Product Design and Development, 4th Edition, Tata McGraw-Hill Publishing Company Limited, ISBN: 978-0-070-14679-2
3. Stephen C. Armstrong (2005), Engineering and Product development Management– The Holistic Approach, Cambridge University Press, ISBN: 978-0-521-01774-9.
4. Thomas A. Sabomone, (1995), What every engineer should know about concurrent engineering, Marcel Dekker Publications, ISBN- 978-0-824-79578-8.

Thank you