UNIT III

PRODUCT DESIGN LIFE CYCLE II

DETAILED DESIGN

DESIGN ANALYSES

- **Design analysis disciplines may include digital circuit, analog circuit, printed circuit board, software, mechanical structure, plastics, etc.**
- **Support disciplines include manufacturing (producibility), testing (testability), logistics, reliability, etc.**
- **Effectively coordinating these disciplines is a difficult process.**
- **Computer-aided design, knowledge bases and networks are areas of technology that is being used by many companies to assist in the transfer of knowledge and information between the design team. These systems have access to databases and the Internet that can contain:**

  (i) CAD drawings and parts, software and materials data

  (ii) Vendor history and information

  (iii) Design rules and lessons learned (both corporate and product Specific)

(iv) Design and support specifications and guidelines (scenarios, product use profiles, performance, producibility, reliability, supportability, and design to cost)
(v) Detailed producibility criteria (capabilities of special and standard processes, testability, and estimated production quantity)
(vi) Detailed reliability criteria (reliability models, failure history, physics of failure, failure mode information)
(vii) Results from prototype testing

- Advanced CAD and design automation systems allow users to create concept models easily and quickly using digital sketching or mathematical models.
- Networks allow the design team to evaluate many concepts in a short period of time.
- In the future automated design advisors and agent based analysis technologies will allow product generation and evaluation to be completed almost instantaneously.

- **Paperless designs automatically determine how the parts could be manufactured and assembled.**
- **Data from projects that have implemented computer-aided engineering tools indicate that design cycle time can be reduced as much as 60%, while producing equal or superior product quality (Swerling, 1992).**
- **Design trade-off studies examine alternative design approaches and different parameters for the purpose of optimizing the overall performance of the system and reducing technical risk.**
- **Trade-off studies are directed at finding a proper balance between the many demands on a design.**
- **The goal is to prevent problems rather than fixing them later. Otherwise, the analyses merely record information about the design after the fact. Changes made later in a program are more costly and less likely to be incorporated.**

PROTOTYPES IN DETAILED DESIGN

- **Prototypes play a large role in all phases of development especially in detailed design.**
- **Physical models and software models (virtual reality) are used to gather information to reduce uncertainty, optimize parameters and test the design.**

Prototyping provides information that is especially important for:

1. **Information that is not available**
2. **Software and software interfaces**
3. **Global and cultural design aspects**
4. **Innovative or creative products that are very different from the norm**
5. **Data for unknown uses or environments**

TEST AND EVALUATION

IMPORTANT DEFINITIONS

DEVELOPMENTAL TEST AND EVALUATION

An integrated series of evaluations leading to the common goal of design improvement and qualification.

- All reviews and tests are organized to improve the product.
- All identified problems and detected failures result in analysis and corrective action.
- A planned program requires that all available test data be reported in a consistent format and analyzed to determine reliability growth and the level of technical risk.

VALIDATION

Process of insuring that the design meets the customer's expectations.

- The level of verification is directly related to how well the requirement definition phase was performed.

VERIFICATION

Process of insuring that the design and manufacturing can meet all design requirements.

- Will the design and support system meet the design requirements?
- The level of verification is related to the quality of the design process, test and evaluation phase and manufacturing test.

DESIGN REVIEWS

Used to identify problems and technical risks in a design's performance, reliability, testing, manufacturing processes, producibility, and use.

- A successful design review will identify improvements for the product.
- A major problem occurs when design reviews are conducted as project reviews, where only a simple overview of the design is given.

BEST PRACTICES FOR TEST AND EVALUATION

The goal of every test and evaluation method is to identify areas for design improvement. The key practices are:

- Test and evaluation strategy effectively coordinates all tests to verify a design's maturity in a cost-effective manner.
- Design reviews use a multidisciplinary approach for evaluating and improving all parameters of a design including producibility, reliability, and other support areas.
- Prototyping, design modeling and simulation are used to both validate and verify the design, identify problems and solicit ideas for improvement.
- Design for test is used to design the product for easy and effective test.
- A test, analyze, and fix methodology is used to identify areas for design improvement to maximize the reliability growth process.

- Software test and evaluation uses proven methodologies to ensure effective verification and identify areas for improvement.
- Environmental, accelerated life, and HALT testing of critical components is initiated early in the program.
- Qualifying new parts, technologies, and vendors are started early and used for improving the product and reducing technical risk.
- Production testing considers all quality control tests including incoming testing and environmental stress testing.

References

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Thank you