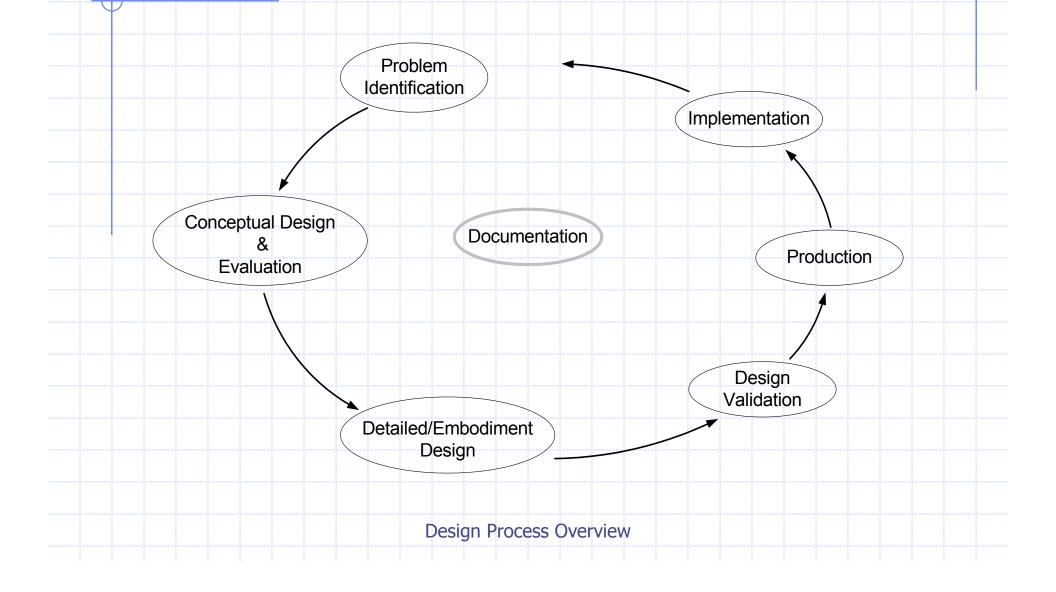
## **Design Process Overview**

Professor Frank J. Fronczak Mechanical Engineering Department & Biomedical Engineering Department University of Wisconsin-Madison

# Design Process - Idealized



# **Problem Identification**

- Problem Statement
  - Concise statement of the needs
- **Design Specification** 
  - Detailed transformation into engineering specifications

Problem Identification

Detailed/Embodiment

Documentatio

Conceptual Design

ጲ

Evaluation

Implementation

Design Validation

Production



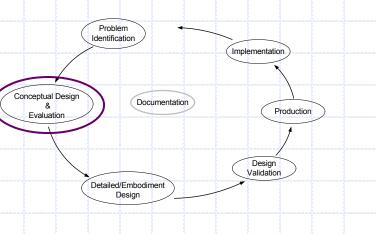
## **Concept Generation**

#### Generate Multiple Potential Solutions

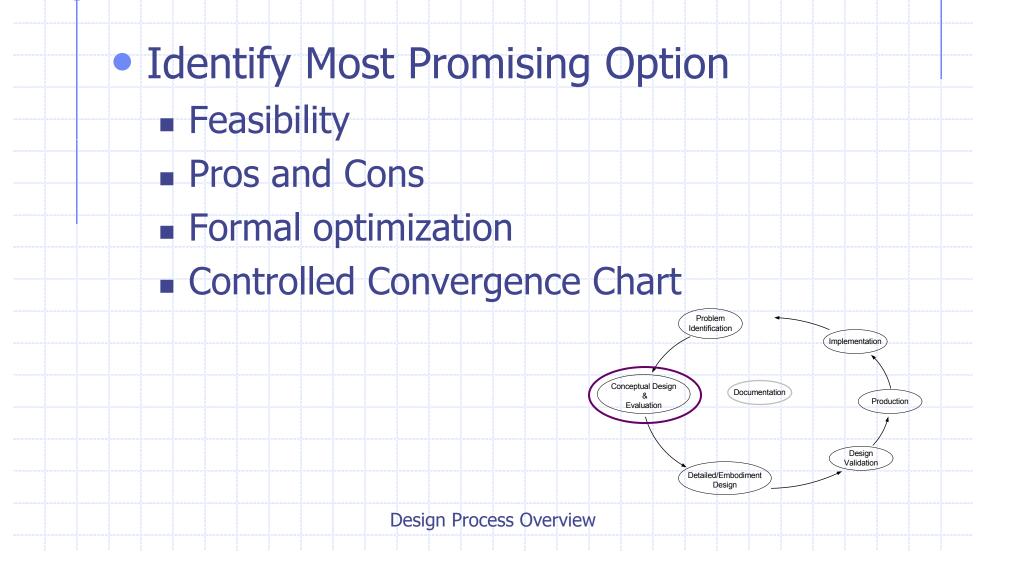
#### Functional decomposition

Physical >> Abstract

- Energy
- Material
- Information
- Brainstorming
  - Osborne's Checklist
- Morphological Chart



#### **Concept Evaluation**

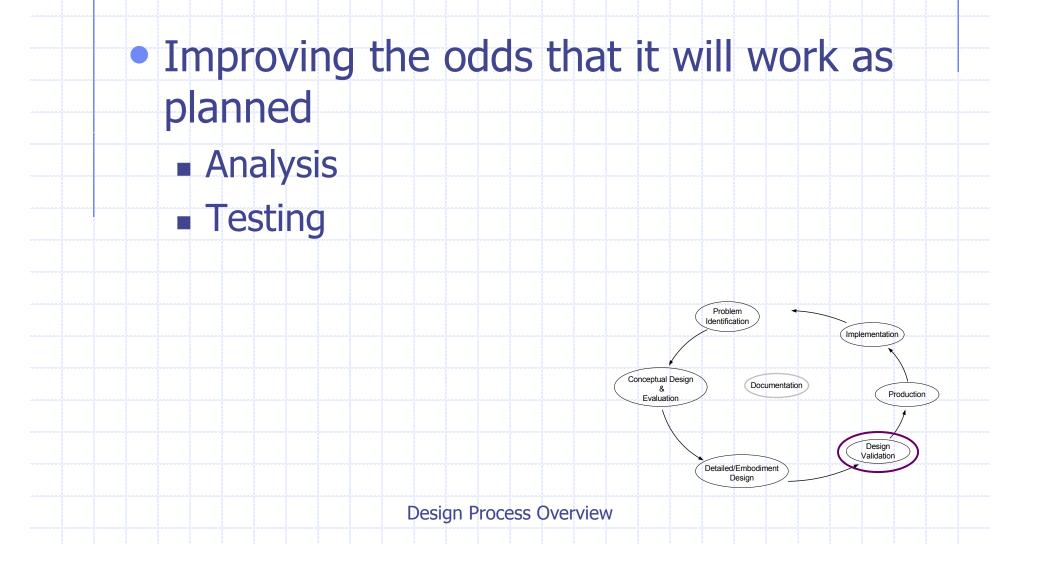




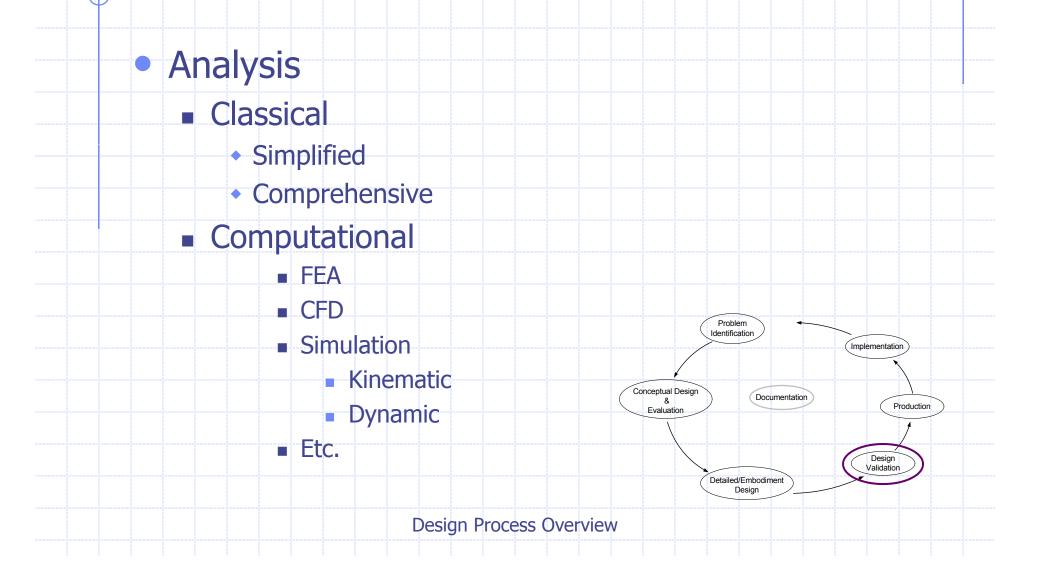
- Working out the details
  - Design for .... DFX
    - Safety
    - Manufacturability
    - Assembly
    - Environment
    - Effective material usage strength, stiffness
    - Ergonomics
    - Etc.

Problem ldentification (Implementation R Evaluation Documentation Production Production Production Design Validation Design Process Overview

## **Design Validation**

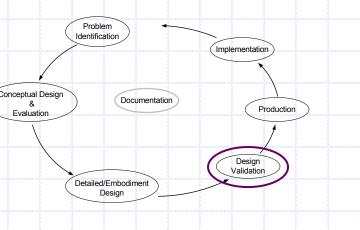


# Design Validation - Analysis

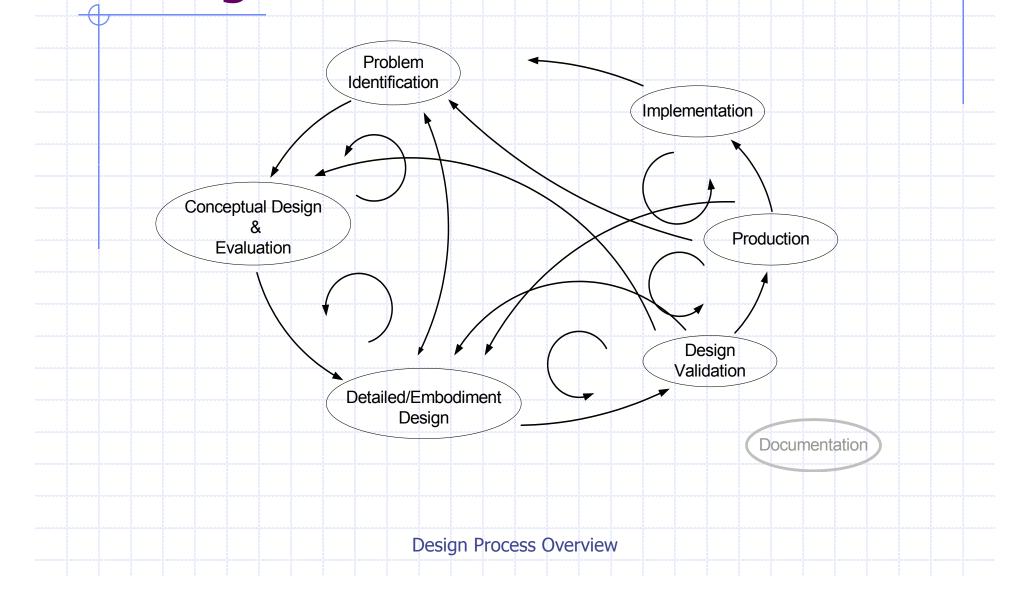


## Design Validation - Testing

 Mock-ups Spatial/layout issues Proof-of-concept devices Independent functional issues Prototypes Operational issues Conceptual Design ጲ Evaluation



# Design Process - Actual



#### What it Takes

- Knowledge
  - Engineering, math, and science principles
  - Technology
- Skill
  - Ability to utilize knowledge
- Attitude
  - Explorer
  - Persistence

# **Selected References**

- The Mechanical Design Process, David Ullman
- Engineering Design Methods Strategies for Product Design, Nigel Cross
- Engineering Design A Project Based Introduction, Clive Dym and Patrick Little
- Engineering Design A Materials and Processing Approach, George Dieter
- Engineering Design A Systematic Approach, Pahl and Beitz