ME560 MODELING and ANALYSIS OF DYNAMIC SYSTEMS
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THE MODELING PROCESS

1. Determine the Model Objective.

- This can only be derived from the problem context (i.e., the ENGINEERING specifications)

2. Define the system.

- What are inputs and outputs of the system. This depends on your viewpoint!

3. Divide and Conquer

- Separate the system into its **essential** *components*.

4. Determine the Interconnections between Components

- How the components constrained with respect to each other

5. Assign Elements to each components

- Assign to each component basic *elements* that best represent their attributes (e.g., mass (energy storage), compliance (energy storage), resistance (energy "dissipation")).

6. Determine the Interconnections between Elements

7. Quantify the Components behavior (Constitutive Law)

- Determine the form and parameters of the constitutive laws for each basic element.

⇒ General Laws ($p = mv$)
⇒ Testing (e.g., $F = Kx^3$)

8. Derive the Governing Equations

- Computers can usually do this easily.

9. Validate the Model

- Use your engineering judgment for intuitive scenarios (e.g. steady-state).
- Compare to test data from the physical system if available. Collect as much data under as many conditions as possible.

10. Assess the "Properness" of the model

- Use Analytical and Numerical Techniques to assess the relative importance of each element and structural connection. Eliminate those that are unnecessary for the model to meet the modeling objective set forth in 1) and go to 8).

11. Repeat

- Keep track of Assumptions, Idealizations and Limitations of your model.

Created: September 5, 1996
Updated: January 7, 2002
Printed: January 5, 2004