ME 5550 Intermediate Dynamics

Topic List

1. Kinematics
   - Angular Velocity and Acceleration
   - Derivatives of a Vector in Multiple Reference Frames
   - Addition Rule for Angular Velocity
   - Relative Motion of Two Points Fixed on a Rigid Body
   - Motion of a Point that is Moving on a Rigid Body - Coriolis Acceleration
   - Orientation of a Rigid Body - Euler Angles

2. Inertia, Momentum and Kinetic Energy
   - Inertia Matrix (Moments and Products of Inertia, Principal Axes, Parallel Axis Theorem)
   - Angular Momentum
   - Kinetic Energy

3. Newtonian Dynamics
   - Newton’s Laws of Motion
     - Rotation about a Fixed Axis - Rotating Mass Imbalance
     - Gyroscopic Effects
   - Euler’s Equations of Rotational Motion

4. Lagrangian Dynamics and Virtual Work
   - Generalized Forces and the Principle of Virtual Work
   - Lagrange’s Equations of Motion
   - Linearization of Equations of Motion about Equilibrium Points
   - Vibration of Linear Multi-Degree-of-Freedom Systems
     - Linear Equations of Motion
     - Mode Shapes and Natural Frequencies
     - Response by Modal Analysis
   - System Stability

5. Introduction to Multibody System Dynamics
   - Systems of Interconnected Rigid Bodies
   - Lagrange’s Equations of Motion with Constraints