

## AA 242B / ME 242B: MECHANICAL VIBRATIONS

### **1. Review of Analytical Dynamics of Discrete Systems**

- 1.1 Principle of virtual work for a particle
- 1.2 Extension to a system of particles
- 1.3 Hamilton's principle for conservative systems
- 1.4 The Lagrange equations

### **2. Undamped Vibrations of N-Degree-of-Freedom Systems**

- 2.1 Linear vibration about an equilibrium configuration
- 2.2 Normal modes of vibration and orthogonality of vibration eigenmodes
- 2.3 Free vibrations
- 2.4 Vector and matrix spectral expansions using eigenmodes
- 2.5 Forced harmonic response
- 2.6 Response to external loading
- 2.7 Variational methods for eigenvalue characterization
- 2.8 Rayleigh's theorem on constraints

### **3. Damped Vibrations of N-Degree-of-Freedom Systems**

- 3.1 Damped oscillations in terms of normal eigen solutions of the undamped system
- 3.2 State-space formulation and analysis of viscously damped systems

### **4. Continuous Systems**

- 4.1 Kinematic description of the dynamics of continuous systems: Hamilton's principle
- 4.2 Wave propagation in a homogeneous elastic medium
- 4.3 Free vibrations of continuous systems and response to external excitation

### **5. Approximation of Continuous Systems by Displacement Methods**

- 5.1 The Rayleigh-Ritz method
- 5.2 The finite element method

### **6. Solution Methods for the Eigenvalue Problem**

- 6.1 Eigenvector iteration method
- 6.2 Subspace construction methods
- 6.4 Reduction and substructuring methods
- 6.5 Iteration in the case of rigid body modes

### **7. Direct Time-Integration Methods**

- 7.1 Stability and accuracy of time integration operators
- 7.2 Newmark's family of methods
- 7.3 Explicit time integration using the central difference algorithm

### **Students with Documented Disabilities**

Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Student Disability Resource Center (SDRC) located within the Office of Accessible Education (OAE). SDRC staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an *Accommodation Letter* for faculty dated in the current quarter in which the request is being made. Students should contact the SDRC as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk (phone: 723-1066).