

# AE 6231: SYSTEM IDENTIFICATION IN STRUCTURAL DYNAMICS

## LIST OF TOPICS

1. **Introduction** 1 hour
2. **Structural Dynamic System Models** 6 hours
  - Review of lumped-parameter models
  - Distributed parameter system models
  - Discrete D.O.F. models
  - Transfer function models
  - Impulse-response and two-step response models
  - State-Space models
  - Transition matrix
  - Discrete time-discrete D.O.F. models
  - Different damping models
  - S.D.O.F. system identification
  - Output error and equation error methods
3. **Identification M.D.O.F. Structural Dynamics System Identification** 6 hours
  - Response of systems with proportional and arbitrary linear damping
  - Complex exponential method for modal identification
  - Poly reference techniques
  - Experimental techniques
  - Assignment of an identification project for the semester
4. **Eigen Realization Methods** 7 hours
  - Markov parameters
  - Henkel matrix
  - Relationship between eigen parameter of discrete time and continuous time state matrices
  - Singular value decomposition
  - Eigen-realization method to identify state matrices, modes, damping ratios and eigenvalues,
  - Examples
  - Observer kalman/filter identification
5. **Frequency Domain Identification** 5 hours
  - Circle-fit methods
  - S.D.O.F. Identification techniques
  - M.D.O.F. Identification techniques
  - Pole-residue method
  - Identification of Markov parameters by left and right matrix fraction description
6. **Identification and Noise** 6 hours
  - Least squares methods with noise
  - Weighted least squares method
  - Bias and consistency of identified parameters
  - Generalized least squares
  - Method of maximum likelihood and instrumental variable method

<b>7. On-Line Identification Methods</b>	5 hours
Recursive least squares	
Recursive maximum likelihood and instrumental variable method	
<b>8. System Model Parameters from Modal Parameters</b>	5 hours
Model reconstruction from Baruch and MCKID methods	
Identification of physically interpretable and system parameters	
Perturbation methods	
<b>9. Introduction to Nonlinear System Identification</b>	3 hours
Volterra method	
Perturbation methods and Hamerstein methods	
<b>Midterm Exam</b>	1 hour
<b>Semester Project with Tests</b>	