CE241 August 3:0

Advanced Structural Dynamics

Instructor

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Department: Civil Engineering

Course Time: MWF 2-3

Lecture venue:

Detailed Course Page:

Announcements

Brief description of the course

This is a follow up of the introductory course CE210 on Structural Dynamics. FE modelling for linear structural dynamics is introduced and methods for numerical integration of equilibrium are covered. The course then moves ion to treatment of uncertainties in loads followed by treatment of inverse problems pertaining to system and load identification. The latter aspects are treated within the framework of Bayesian state estimation methods.

Prerequisites

CE 210 [Structural Dynamics] or equivalent, and background in probability models

Syllabus

FE models for dynamics of built-up structures. Integration of equations of equilibrium. Explicit and implicit methods. Treatment of uncertainty in vibration problems. Random process models for loads. Simulation based approaches. Reduction of sampling variance. FE model updating. Bayesian framework for system identification. MCMC samplers. Kalman and particle filters.

Course outcomes

Felicity with FE modelling of vibrating structures.

An understanding of role of uncertainties in loads (such as earthquake, wind, moving loads, and road roughness).

Introduction to modern concepts in structural health monitoring.

Grading policy

30% for tests (3 tests)

20% for assignments (~4 assignments)

20% for a term paper presentation

30% for final examination

Assignments

After about every six lectures one assignment would be assigned.

1. The assignments should be submitted before 12:00 hours of the last date announced for submission. Late submissions carry penalty of 10% of marks per day. Assignments that are submitted after five days of the last date would be assigned zero marks.

2. Work should be well organized and done neatly. All assumptions made must be clearly stated with adequate justifications. The pages should be numbered and stapled securely. All graphs must bear axes labels, legends and captions. Equations of motion should be derived based on clearly drawn free body diagrams. All numerical results should be reported with appropriate number of significant digits and must bear the correct units.

3. Problems requiring numerical work could be done on the Matlab platform. In this event, the Matlab code should be included in the document to be submitted along with suitable printouts of the numerical results and graphs.

Resources

1. Yuen, Ka-Veng. Bayesian methods for structural dynamics and civil engineering. John Wiley & Sons, NY, 2010.

2. Petyt, Maurice. Introduction to finite element vibration analysis. Cambridge University Press, 2010. Cambridge,

3. Bathe, Klaus-JÃ¼rgen. Finite element procedures. PHI, New Delhi, 2006.
Current literature.