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Vibrations of Plates and Shells

Instructor

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Department: Mechanical Engineering

Course Time:

Lecture venue:

Detailed Course Page:

Announcements

Brief description of the course

The course is about vibrations of continuous systems such as beams, plates of different shapes, shells of different geometries, rings. These systems are encountered in everyday life. Automobile bodies can be modelled as plates or shells, the chassis is a connected set of beams. This is a graduate level course. Although the course assumes no particular background, a basic knowledge of mechanics and vibrations will be helpful.

Prerequisites

A basic course in solid mechanics.

Syllabus

Starting with displacements in curvilinear coordinates, deformations and strains are obtained which are linearized. The differential element and its deformation are derived using Lamé parameters and radii of curvature. Then stresses and force resultants are derived. These are used in the Hamiltons Law to derive the most general set of equations of motion for a thin shell of any general geometry. These equations are then specialized for different systems: beams, plates, shells of various shapes and geometries. Next, boundary conditions are applied and modeshapes and resonances are derived. Following this the forced response is

derived for different types of forces. Lastly, combinations of systems is studied using the receptance method.

Course outcomes

The student will learn about

- 1) infinitesimal displacements in curvilinear coordinates. He/she will learn about nonlinear strains and how to linearize them.
- 2) about a general set of equations of motion for vibrating continuous systems.
- 3) Modeshapes and resonances.
- 4) how to compute the forced response for any type of forcing.
- 5) the receptance method.

Grading policy

- 1) 20% for assignments
- 2) 15% each for two mid term exams
- 3) 50% for the final written exam

Assignments

four assignments are given that follows the course material. These are intensive enough that each takes about 3 weeks,

Resources

Vibrations of shells and plates by Werner Soedel.