Vibration control - Web course

COURSE OUTLINE

The main objective of course is to presents fundamentals to a modern treatment of vibrations, placing the emphasis on analytical developments and computational solutions. This course will provide the detail knowledge about nonlinear and random vibration with fault diagnosis of machinery using vibration signature analysis.

Contents: Review of free and forced vibrations with and without damping; Vibration isolation and taransmissibility; Undamped vibration absorbers; generalized coordinates and coordinate coupling; Orthogonality of modes; Free and forced vibration of multidegree of freedom systems with and without viscous damping; Lagrange's equation; Holzer's method. Solution of eigen value problem, transfer matrix and modal analysis.

Self excited vibrations. Criterion of stability; Effect of friction on stability. Introduction to non-linear vibrations; Free vibrations with non-linear spring force or non-linear damping; Phase plane; Energy curves; Lienard's graphical construction; Method of isoclines. Vibrations of strings; Free and forced longitudinal vibrations of prismatic bars; Ritz and Galerkin methods. Mathematical discriptions of stochastic proceses; Stationary a n d ergodicity; Gaussion random process, Correlation functions and power spectral density. Introduction to diagonastic maintenance and signature analysis

COURSE DETAIL

Sl. No	Topic	Hours
1.	**Introduction:** Review of free and forced vibrast iownith and without damping.	2
2.	**Vibration isolation:** and transmissibilityU; n-damped vibration absorbers.	3

NP-TEL

NPTEL

http://nptel.ac.in

Mechanical Engineering

Pre-requisites:

- Understanding of basic concept of welding UG course on Basic Manufacturing Processes.

Coordinators:

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3.	**Generalized coordinates:** and coordinate coupling; Orthogonality of modes.	4
4.	**MDOF systems:** Free and forced vibrantio of multi-degree of freedom systems with and without viscous damping; Lagrange's equation; Holzer's method. Solution of Eigen value problem transfer matrix and modal analysis.	8
5.	**Self excited vibrations:** Criterion of stability; Effect of friction on stability.	4
6.	**Nonlinear Vibrations:** Introduction; Free vibrations with nonlinear spring force or nonlinea rdamping; Phase plane; Energy curves; Lienard's graphical construction; Method of isoclines.	4
7.	**Continuous Systems:** Vibrations of strings; Free and forced longitudinal vibrations of ispmratic bars; Ritz and Galerkin methods.	5
8.	**Random Vibration:** Mathematical descriptions of stochastic processes; Stationary and ergodicity; Gaussian random process, Correlation functions and power spectral density.	5
9.	**Diagnosis:** Introduction to diagnostic maintenance and signature analysis.	5

References:

1. Mechanical Vibrations, S. S. Rao, Pearson Education Inc. (4th Ed.), 2007.
2. Fundamental of Vibrations Leonard Meirovitch, Mc-Graw Hill Inc., 2001
3. Vibration and Control, D. J. Inman, John Willey & Sons Inc, 2002
4. Mechanical Vibrations, S. Tamadonni & Graham S. Kelly, Schaum's Out line Series, Mc-Graw Hill Inc, 1998.

5. Vibration Condition Monitoring of Machines, J. S. Rao, Tata Mc-Graw Hill, 2006