INTRODUCTION AUX VIBRATIONS NON-LINÉAIRES

INTRODUCTION TO NONLINEAR VIBRATIONS

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| Lecturers : 16.0 | TC : 0.0 | PW : 8.0 | Autonomy : 0.0 | Study : 4.0 | Project : 0.0 | Language : FR

Objectives

This course is an introduction to the main phenomena related to the problems of nonlinear vibrations. The minimum knowledge and rules useful to the engineer will be introduced to diagnose and treat these problems. Many examples from engineering problems will illustrate the course. We can mention the dynamics of frictional contacts (squeal noise), clearance systems (rattling), rotors dynamics and gear transmissions, bridges subjected to wind .

Keywords : nonlinear vibrations, dynamics of systems, stability, bifurcations, nonlinear modes, principal resonances, super-harmonics, sub-harmonics, self-sustained vibrations, galloping, flutter phenome

Programme

* Generalities on nonlinear vibratory problems in engineering, classification of sources
* Description and Analysis Tools, Nonlinear Modal Analysis
* Loss of equilibrium stability and self-sustained vibrations (galloping phenomena, squealing)
* Phenomena of nonlinear resonances (principal and harmonics)
* Concept of strange responses (chaos)
* Introduction to methods specific to the treatment of nonlinear phenomen

Learning outcomes

- detect and / or diagnose nonlinear vibration phenomena
- characterize the main kinds of vibration responses
- identify the main phenomena that lead to these dynamic responses
- model some nonlinear problems and use specific methods

Independent study

Objectifs : Study of vibro impacting systems and hertzian contacts under normal excitations.
Study of friction instabilities.
Practical methods devoted to nonlinear problems
knowledge of several scenarii inducing chaos.

Méhodes : Practical works, Design project

Core texts

A. H. Nayfeh, B. Balachandran. , *APPLIED NONLINEAR DYNAMICS: ANALYTICAL, COMPUTATIONAL AND EXPERIMENTAL METHODS*, J. Wiley, 1995
Vidal, Bergé, Pommeau *L'ORDRE DANS LE CHAOS*, Hermann, 1984
Manneville, P.*INSTABILITÉS, CHAOS ET TURBULENCE*, Ecole Polytechnique, 2004

Assessment

final = 50% knowledge + 50% know how
knowledge = 100% final exam
know how = 100% continuous monitoring