
Dynamics of mechanical systems

Finalità

The course is an advanced course in dynamics of mechanical systems.

The students will be introduced to the processes of modelling real mechanical system, to the development of the governing differential equations associated with dynamic mechanical systems and to the definition of possible methods of solution to the systems governing equation.

Programma

Introduction and definitions

Examples of mechanical systems

Different approaches to the dynamical study of mechanical systems

Principles of dynamics: general considerations.

Principle of virtual work, D'Alembert's principle, Hamilton's principle

Lagrange equations for lumped and continuous systems

Rayleigh-Ritz method

Linearisation of the equations of motion

Linear systems: convolution integral and impulse response

Fourier transform and other transforms

Introduction to frequency analysis

Nonlinear problems

Wave motion in elastic solids

Wave and vibration in strings, bars and plates

Group velocity and energy flow

Reflection and transmission of elastic waves

Wave motion in periodic structures

Attività d'esercitazione

Some exercises will be carried out in the lab, where the students will perform some numerical exercises using the software MATLAB

Modalità d'esame

The exam consists in a written exam during the course and an oral exam at the end of the course.

Propedeuticità

Mathematical analysis, physics, geometry, rational mechanics and applied mechanics are recommended.

Testi consigliati

L. Meirovitch, Elements of Vibration Analysis, 2nd edition, McGraw Hill, 1986.

K.F. Graff, Wave Motion in Elastic Solids, Dover, 1991.