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'Alambert'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.