



Course: COMPUTATIONAL METHODS IN NONLINEAR DYNAMICS		Teaching Language: Italian
SSD (Subject Areas): CEAR-06/A		CREDITS: 9
Course year: I/II	Type of Educational Activity: D	
Teaching Methods: in presence		
Contents extracted from the SSD declaratory consistent with the training objectives of the course: The course, after a general introduction to nonlinear dynamics, with a quick historical excursus, intends to place particular emphasis on the most widespread nonlinear phenomena in applications and on the related computational methods used for the study of their response and their stability. Specifically, discrete and continuous systems will be considered, introducing basic concepts such as phase space, phase trajectories and portraits, periodic, quasi-periodic and chaotic responses, attractors and basins of attraction, Poincarè sections, stability of solutions and bifurcations, sub- and super-harmonic resonances, highlighting a wide range of phenomena typically exhibited by nonlinear dynamical systems (think for example, the problems of flutter instability that, together with other nonlinear phenomena, were responsible for the structural collapse of the Tacoma Narrow Bridge or synchronization phenomena, such as the pedestrian-structure interaction capable of destabilizing the dynamics of the Millennium Bridge pedestrian bridge in London, before it was adequately equipped with viscous dampers, resonant mass inertia dampers etc.). Paradigmatic models such as Duffing and Van der Pol oscillators, Lorenz and Rössler systems, logistics application and Feigenbaum tree etc. will be illustrated. Hints will be provided to applications of more strictly engineering interest such as, for example, nonlinear energy sinks (NES), which represent an interesting improvement of linear tuned mass dampers, allowing on the one hand the use of smaller masses and on the other a simultaneous expansion of the range of suppressed frequencies, or as the structural isolation from vibrations induced by ground movements due to the phenomenon of localization. Subsequently, attention will be paid to the main computational methods used for the study of nonlinear systems and their stability. In particular, distinct groups of methods will be considered, such as weighted residue methods, finite difference methods, asymptotic methods and variational iteration-collocation methods, as well as the concept of nonlinear normal modes (NNM), a tool widely used to study the forced responses of nonlinear systems.		
Objectives: Introduce students to the topics of structural analysis and calculation in a nonlinear field.		
Propaedeutcities: None		
Is a propaedeuticity for: None		
Types of examinations and other tests: Oral exam		