Course unit English denomination	Nonlinear continuum mechanics for finite element analysis
Teacher in charge (if defined)	Nico De Marchi
Teaching Hours	24
Number of ECTS credits allocated	4
Course period	July
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (60% minimum of presence) ☐ No
Course unit contents	1) The Finite Element Method in nonlinear solid mechanics; 2) Solution procedures: - Newton Raphson algorithm; - Line search method; - Orthogonal residual method; - Arc-length method. 3) Hyperelasticity ; 4) The mathematical theory of plasticity; 5) Large strain elasto-plasticity: - Multiplicative decomposition of the stretch; - Rate-independent plasticity; - Incremental cinematic; - Stress update and return mapping; - Algorithmic tangent modulus. 6) Viscoplasticity (classical rate-dependent model); 7) Viscoelasticity ; 8) Continuum damage models; 9) Anisotropic constitutive models; 10) Basics of contact mechanics.
Learning goals	The course focuses on the analysis and modeling of solids and structures in the nonlinear regime of material and geometry. Particular attention is paid to the development of the theory in a form suitable for modeling and numerical implementation. The idea is to present the theory and the corresponding numerical methods as a gradual development for computer execution. Participants will understand the main sources of nonlinearity in solid mechanics and will acquire the tools and skills to effectively address this type of problem.
Teaching methods	Frontal lessons on the blackboard and multimedia lessons on the computer
Course on transversal, interdisciplinary,	☒ Yes ☐ No

transdisciplinary skills	
Available for PhD students from other courses	☒ Yes ☐ No
Prerequisites (not mandatory)	The student should possess the knowledge provided by the courses of: Solid Mechanics, Computational Mechanics, Numerical Methods and Elements of Tensor and Numerical Algebra
Examination methods (in applicable)	Development of a numerical exercise and oral discussion.
Suggested readings	Course notes and the following books: - Simo, Juan C., and Thomas JR Hughes. Computational inelasticity. Vol. 7. Springer Science & Business Media, 2006 - de Souza Neto, Eduardo A., Djordje Peric, and David RJ Owen. Computational methods for plasticity: theory and applications. John Wiley & Sons, 2011 - Bonet, Javier, and Richard D. Wood. Nonlinear continuum mechanics for finite element analysis. 1997 - Cowin, Stephen C. Continuum mechanics of anisotropic materials. Springer Science & Business Media, 2013
Additional information	/