UNIVERSITA' DEGLI STUDI DI NAPOLI FEDERICO II

DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA
CORSO DI DOTTORATO DI RICERCA IN
INGEGNERIA STRUTTURALE GEOTECNICA E RISCHIO SISMICO

XXXIX CICLO

Il sottoscritto prof. Fabio DE ANGELIS

(PO □ PA X RU □ RTD □) afferente al Dipartimento di Strutture per Ingegneria e Architettura

S.S.D. (*indicare codice e nome per esteso)* ICAR/08 – Scienza delle Costruzioni

CHIEDE

di essere inserito tra i possibili tutor di studenti di dottorato per il XXXIX ciclo.

1. Curriculum sintetico del proponente (max 500 parole)

Prof. Fabio De Angelis

Fabio De Angelis graduated in Civil Engineering with full marks (110/110) and Honors (cum Laude) at the Faculty of Engineering of the University of Naples, Italy. He holds a Ph.D. degree in "Structural Engineering" received by the University of Naples. He was recipient of a Post-Doctoral Research Associate Fellowship in 1999-2001 and an International Mobility of Researchers Fellowship in 2008-2009.
He is currently Associate Professor with Tenure in the scientific disciplinary field "Mechanics of Solids and Structures" (Scienza delle Costruzioni) at the Department of Structures for Engineering and Architecture of the University of Naples Federico II. Since 2002 he has been teaching the courses "Structural Mechanics" and "Mechanics of Solids" at the Faculty of Engineering of the University of Naples Federico II, Italy. He is currently teaching "Mechanics of Solids I", "Mechanics of Solids II" and "Experimental Analysis of Materials and Diagnostics of Structures".
From 2009 to 2012 he has been Visiting Scientist at the Department of Civil and Environmental Engineering of the University of California at Berkeley (USA), where he worked in collaboration with Professor Robert L. Taylor, co-author of the book "The Finite Element Method" by Zienkiewicz and Taylor.
He is the author of more than 100 papers on indexed recognized and leading peer-reviewed International Journals and International Conferences. His research interests

are related to Mechanics of Solids and Structures, Structural Mechanics, Structural Engineering, Inelastic Behaviour of Solids and Structures, Computational Plasticity and Viscoplasticity, Nonlinear Dynamics of Solids and Structures, Innovative Strategies for the Mitigation of Damage for Solids and Structures subject to Dynamic and Seismic Loadings. In his scientific activity he participated to numerous International Conferences, related to the scientific disciplinary field of Structural Mechanics, in which he presented scientific papers. He has been collaborator in research groups C.N.R. (Italian National Research Council) and M.I.U.R. (Ministry of Education, University and Research) since 1995. He is Coordinator of the Research Project "Innovative Strategies for the Mitigation of the Vulnerability of Structures subject to Extreme Seismic Actions". In his research activity he has financed positions of research grants and research scholarships on his research funds.

2. Dottorandi dei quali il proponente è stato tutor nell'ultimo triennio

n. _____	_____

3. Titolo della ricerca proposta

Nonlinear Elastic and Anelastic Modelling of Solids and Structures

4. Area tematica

Ingegneria Geotecnica □

Ingegneria Strutturale □X

Rischio Sismico □

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5. Tipologia di borsa per la quale si propone il progetto

Ateneo □ X

DM 117 (Investimento 3.3) □
(in questo caso indicare l'azienda co-finanziatrice)

DM 118 (Investimento 4.1 P.A.) □X

DM 118 (Investimento 4.1 generici) □X
DM 118 (Investimento 4.1 Patrimonio culturale) □X

6. Sintesi del progetto di ricerca (max 500 parole. Stato dell'arte, obiettivi e breve programma previsto per le attività e)

Nonlinear Elastic and Anelastic modelling of Solids and Structures has achieved in the last two decades a significant progress, not only in the definition of the appropriate theoretical framework governing the phenomena, but also in the computational treatment of the model problem. On the other hand the problem of the numerical integration of nonlinear behaviour of solids with higher gradients and rate-independent and rate-dependent material behaviour is not trivial. Zienkiewicz and Cormeau developed algorithms for quasi-static elasto/viscoplasticity problems by placing time step restrictions for the Euler forward difference method. Hughes and Taylor proposed the application of implicit methods to quasi-static elasto/viscoplasticity, which require the inversion of a compliance matrix. Pierce et al. proposed a one step forward gradient time integration scheme which leads to a tangent stiffness type method for rate dependent material behaviour. Szabo compared different time integration schemes and proposed a new method for the calculation of the effective plastic/viscoplastic strain increment. Peric used a perturbation method for the solution of stiff equations arising in low rate-sensitive materials. For a comprehensive account we refer to Zienkiewicz and Taylor (The Finite Element Method for Solid and Structural Mechanics, 7th Ed., Elsevier, Oxford, 2013).

In the present research project we analyze the treatment of nonlinear elastic analysis with nonlinear associated elastoplasticity and elasto/viscoplasticity. For the solution of the problem by connecting the equipotential surface with a plastic/viscoplastic multiplier it will be derived an approach which allows to follow the same lines of reasoning used for

rate independent models. An implicit backward difference method will be developed which does not necessitate any matrix inversion. The tangent operator consistent with the algorithmic scheme will be derived which is suitable to be applied to different constitutive models and to arbitrary yield criteria. Comparison will be investigated with nonlinear elastic and anelastic models existing in the literature. Nonlinear kinematic hardening rules will be considered in order to account for cyclic plastic behaviour of solids and structures undergoing cyclic loading conditions. Numerical computations and results will be finally developed in order to illustrate the effectiveness of the algorithmic procedure.

7. Eventuali pubblicazioni del tutor sul tema di ricerca (max 10)

International Journals (Peer-Reviewed):

[1] De Angelis, F., Taylor, R.L., An Efficient Return Mapping Algorithm for Elastoplasticity with Exact Closed Form Solution of the Local Constitutive Problem, ENGINEERING COMPUTATIONS, (ISSN 0264-4401), Vol. 32, Issue 8, pp. 2259 - 2291, 2015. http://dx.doi.org/10.1108/EC-06-2014-0138

[2] De Angelis, F., Taylor, R.L., A Nonlinear Finite Element Plasticity Formulation without Matrix Inversions, FINITE ELEMENTS IN ANALYSIS AND DESIGN, (ISSN: 0168-874X), Vol. 112, pp. 11-25, 2016. http://dx.doi.org/10.1016/j.finel.2015.12.007

[3] De Angelis, F., Cancellara, D., Multifield variational principles and computational aspects in rate plasticity, COMPUTERS AND STRUCTURES, (ISSN: 0045-7949), Vol. 180, pp. 27–39, 2017. http://dx.doi.org/10.1016/j.compstruc.2016.05.011

[4] De Angelis, F., Cancellara, D., Grassia, L., D'Amore, A., The influence of loading rates on hardening effects in elasto/viscoplastic strain-hardening materials, MECHANICS OF TIME-DEPENDENT MATERIALS, (ISSN: 1385-2000), Vol. 22 , Issue 4, pp. 533-551, 2018. https://doi.org/10.1007/s11043-017-9375-7

[5] De Cicco, S., De Angelis, F., A plane strain problem in the theory of elastic materials with voids, MATHEMATICS AND MECHANICS OF SOLIDS, (ISSN: 1081-2865), Vol. 25, Issue 1, pp. 46-59, 1 January 2020. https://doi.org/10.1177/1081286519867109

[6] De Angelis, F., Meola, C., Non-smooth evolutive laws in multisurface elastoplasticity with experimental evidence by infrared thermography, COMPOSITE STRUCTURES, (ISSN: 0263-8223), Vol. 265, Art. n. 113156, pp. 1-9, 1 June 2021.

https://doi.org/10.1016/j.compstruct.2020.113156

[7] De Angelis, F., A multifield variational formulation of viscoplasticity suitable to deal with singularities and non-smooth functions, INT. JOURNAL OF ENGINEERING SCIENCE, (ISSN: 0020-7225), Vol. 172, Art. 103616, pp. 1-16, 1 March 2022.

https://doi.org/10.1016/j.ijengsci.2021.103616

[8] De Angelis, F., An internal variable treatment of evolutive problems in hardening plasticity and viscoplasticity with singularities, CONTINUUM MECHANICS AND THERMODYNAMICS, (ISSN: 0935-1175), Vol. 35, pp. 1807-1819, 2023.

https://doi.org/10.1007/s00161-023-01227-7

[9] Alfano, G., De Angelis, F., Rosati, L., General solution procedures in elasto/ viscoplasticity, COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING, Vol. 190, pp. 5123-5147, Elsevier, (ISSN 0045-7825), Amsterdam, 2001.

http://dx.doi.org/10.1016/S0045-7825(00)00370-4

[10] De Angelis, F., An internal variable variational formulation of viscoplasticity, COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING, Vol. 190, Nos. 1-2, pp. 35-54, Elsevier, (ISSN 0045-7825), Amsterdam, 2000.

http://dx.doi.org/10.1016/S0045-7825(99)00306-0

8. Eventuali progetti di ricerca finanziati in cui l'attività si inserisce

ISMIVUS - Innovative Strategies for the Mitigation of the Vulnerability of Structures subject to Extreme Seismic Actions (Ricerca di Ateneo).

9. Eventuali fondi disponibili a supporto dell'attività del dottorando (escluso finanziamento borse)

10. Informazioni relative ad un periodo di ricerca all'estero (minimo tre mesi) previsto per il dottorando (*indicare Università/ente di ricerca e docente/ricercatore di riferimento* con indirizzo mail) (max 300 parole)
The research project will be developed by considering a research period abroad (minimum three months) in which the research activity is realized in collaboration with Prof. Robert L. Taylor, at the Department of Civil and Environmental Engineering, University of California Berkely (Usa).

11. Eventuali collaborazioni con imprese/aziende sul tema di ricerca (max 300 parole)

Napoli, 29/06/2023 FIRMA

Il presente modulo va compilato in ogni sua parte ed inviato all'indirizzo di posta elettronica phd.dist@unina.it entro e non oltre **il 30/06/2023.**