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.

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

S.S.D. 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)

Dr. Salvatore Sessa is Associate Professor at the University of Naples Federico II since 2022. He graduated in Civil Engineering in 2006 and got his PhD in Engineering of Materials and Structures in 2009. During the PhD course, his research was focused on computational algorithms for the random vibration analysis of structures with asymmetric hysteresis and he has been visiting scholar at the University of California, Berkeley, for 18 months under the supervision of the Taisei professor Armen Der Kiureghian.

During his career he was involved in more than 10 research projects at the University of Naples Federico II, University of Naples, Parthenope and at the Politecnico di Milano, published 20 papers in international journals and presented several contributions at national and international conferences.

His research activities concerned several fields of structural engineering including:

- identification of constitutive parameters of cohesive delamination of bonded joints;
- Finite element seismic analysis of nonlinear framed and shell structures;
- Analysis of elastic half-spaces subject to surface loading;

- Computational algorithms for random vibration analysis by finite elements.

His investigations about delamination concerned the identification of the constitutive parameters of double-cantilever-beam specimens subjected to Mode-I and/or Mode-III cohesive delamination based on full-field kinematic data obtained by Digital Image Correlation.

In 2014 he got a postdoc position at the University of Naples Federico II where he investigated nonlinear analysis of structures and implementation of shell finite elements accounting for transverse confinement.

From 2016 to 2019 he worked as junior researcher (RTDA) and from 2019 to 2022 as tenure-track researcher (RTDB). He focused his research on the developments of computational algorithms concerning the nonlinear dynamic analysis of structures. Moreover, he was teacher of Theory of Structures and supervised several bachelor and master thesis in Civil Engineering, Mechanical Engineering and Architecture.

He is member ASCE (American Society of Civil Engineers) since 2015, of the IFIP WG7.5 – International Federation for Information Processing – Work Group 7.5 – Reliability and Optimization of Structural Systems, dal 2012 and of the AIMETA (Associazione Italiana di Meccanica Teorica ed Applicata) group "Stochastic Mechanics".

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

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3. Titolo della ricerca proposta

Dependence of cohesive fracture parameters on plane stress/plane strain conditions in inverse analysis problems

4. Area tematica

Ingegneria Geotecnica □

Ingegneria Strutturale X

Rischio Sismico □

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.) □

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

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

Determination of the constitutive parameters of adhesive interfaces subjected to cohesive fracture involves the proper determination of full-field kinematic data. For this purpose, the use of Digital Image Correlation (DIC) techniques is a well suited and very appealing strategy.
Within the current state of the art, DIC usually determines the displacements field of experimental tests over a 2D surface of the tested specimen by processing pictures captured by a single camera. The procedure is currently adopted for the identification of parallelepipedal joint assemblies (standardized according to international codes including ISO-29217:2009 and ISO-17281:2002) subject to pure Mode-I, pure Mode-II and Mixed mode I-II fracture. Tests are usually monitored by a camera located on one side of the

specimen with approximately orthogonal orientation. As a consequence, the 2D DIC determines the displacements of the free plane surface of the assembly over which rigorous plane stress conditions are met.
The proper parameter identification is performed by inverse analyses based on a finite element modelling of the experimental test. The theoretical displacement field is compared with the experimental one determined by DIC in order to define suitable objective functions to be minimized. Within the current state-of-the-art, plane stress conditions are also adopted for the finite element model which predicts the theoretical responses.
Recent investigations of the proposer have shown that such assumption can be not consistent with the actual behavior of the experimental specimen. In fact, while the plane stress state is obvious for the points of the lateral surface, because of symmetry considerations, the middle plane of the specimen presents plane strain conditions. Thus, the points belonging to the internal planes present a behavior which is intermediate between plane stress and plane strain and induces triaxial actions.
The proposed research aims at investigating such an issue from three different points of view: experimental, numerical and analytical.

- From the experimental standpoint, joined assemblies with different out-of-plane depths can be tested (under mode-I loading conditions) and monitored by DIC. Full field data will be used for the identification of cohesive parameters with the same forward model under plane stress conditions. At varying the depth, it is of interest to compare critically the results of identification and the experimental displacement contour relevant to the free (monitored) surface.
- From the computational standpoint, the research will compare the responses of two finite element models: a classic one, adopting plane stress and/or plane strain conditions, and a full triaxial model. It is of interest to investigate the distribution of the debonding forces over the thickness of the interface.
- Analytical solutions concerning the stress distribution inside the bulk of the sample at the crack front are available and can provide useful insights on the role of triaxiality ratio.
- Finally, differences between small and large strain assumptions will be investigated.

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

1. Cricrì, G., Perrella, M., Sessa, S., Valoroso, N., A novel fixture for measuring mode III toughness of bonded assemblies. Engineering Fracture Mechanics. 2015, 138: 1-18. 2015.
2. Valoroso, N., Sessa, S., Lepore, M., Cricrì, G., Identification of Mode-I cohesive parameters for bonded interfaces based on DCB test. Engineering Fracture Mechanics. 2013, 104:56-79.
3. R. Fedele, S. Sessa, N. Valoroso. Image correlation-based identification of fracture parameters for structural adhesives. Technische Mechanik. 2012, 32(2): 195-204
4. S. Sessa, R. Serpieri, L. Rosati. Implementation and Finite-Element analysis of shell elements confined by Through-The-Thickness uniaxial devices. First European Conference on OpenSees. Porto, Portugal, 2017.
5. S. Sessa, F. Toraldo, F. Marmo, D. Masi, L. Rosati. Experimental assessment of carbon fiber jacketing of steel plates. 6th International Conference on Computational Methods in Structural Dynamics and Earthquake Engineering - COMPDYN 2017, Rhodes, Greece, 2017;
6. S. Sessa, N. Valoroso, Use of Kriging to surrogate finite element models of bonded double cantilever beams; ICASP12 – 12th International Conference on Applications of Statistics and Probability in Civil Engineering Vancouver, Canada, July 12th–15th, 2015;
7. S. Sessa, F. Marmo, N. Valoroso Structural acceptance test strategy using Bayesian Networks; XX AIMETA Conference, Bologna, September 12th-15th, 2011;

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

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)
Research activities include a visiting appointment of 6 months at the Zhejiang University under the supervision of Dr. Cristoforo Demartino cristoforodemartino@intl.zju.edu.cn . The appointment will be focused on an experimental campaign in which innovative devices for Digital Image Correlation will be used to detect kinematic fields of Mixed-Mode delamination.

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

Napoli, 23/06/2023

FIRMA

Prof. Salvatore Sessa

(Firmato digitalmente)

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.**