



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. ANTONIO FORMISANO

(PO PA RU RTD) afferente al Dipartimento di STRUTTURE
PER L'INGEGNERIA E L'ARCHITETTURA

S.S.D. (ICAR/09 TECNICA 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)

Antonio Formisano is Associate Professor of Structural Design at the Department of Structures for Engineering and Architecture of the University of Naples "Federico II". Qualified as Full Professor in 2021, he is lecturer in courses on metal structures and vulnerability and seismic retrofitting of existing buildings within the framework of the International Masters ETeC, Design of Steel Structures in Smart Cities, SUSCOS, ELARCH, ArINT and DYCLAM. His research is mainly focused on the following topics: analysis of steel and aluminium alloy structural systems and connections; seismic vulnerability analysis of masonry buildings, with particular reference to building aggregates in historic centres, and reinforced concrete ones; vulnerability and seismic risk of historic centres; seismic consolidation of existing structures by systems based on the use of metal materials; seismic analysis of cold-formed thin walled structures; robustness of steel structures; composite materials made of natural fibres, life cycle assessment and energy requalification of buildings. He is the author of about 500 publications published in national and international journals and books, as well as on national and international conference proceedings, where he participated as speaker and chairman. His records on Scopus are as follows: Documents 251, Citations: 3437, H index: 34 (updated on 23/06/23). He was part of the working group that delivered the technical document CNR-DT 208/2011 on the design of aluminium alloy structures. He was a consultant of UNI for the translation of EuroCode 3 Part 1.8 on the design of steel joints. Currently he is a member of the



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

project teams for the development of the new version of Eurocode 9 “Design of aluminium alloy structures” He was member of the editorial and scientific committee of numerous national and international conferences and congresses. He participated and is participating as a member and coordinator of numerous national and international research projects. He is a member of the editorial board and reviewer of numerous national and international journals. He held lectures and seminars at several Universities and National and International Research Centres, as well as training courses at Universities and Professional Orders on European Community marking, design of steel and aluminium structures and connections, seismic vulnerability and retrofitting of existing buildings, study and experimentation on new eco-friendly building materials. He received awards in the fields of Structural Engineering and Green buildings. In particular, he was featured among the World's Top 2% Scientists 2021 and 2022, as published by Stanford University on Plos Biology.

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

n. 3

ANTONIO DAVINO (ATENE0), EMILIA MEGLIO (PON DM 1061) E GIOVANNA LONGOBARDI (ATENE0)

3. Titolo della ricerca proposta

FRP AND FRCM SYSTEMS MADE OF NATURAL FIBRES FOR SEISMIC-ENERGY RETROFIT OF EXISTING RC AND MASONRY BUILDINGS

4. Area tematica

Ingegneria Geotecnica

Ingegneria Strutturale



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

Rischio Sismico

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

Ateneo

DM 117 (Investimento 3.3) OLYMPUS SRL – Via Riviera di Chiaia n. 118 – 80122 Napoli

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)

The research activities aim at implementing, studying, and testing natural fibres as constitutive elements of FRP and FRCM systems for integrated seismic-energy efficient applications in the Civil Building sector for the upgrading of existing buildings. The activities will be developed according to two different lines of research. In the first line of research, the use of natural fibres (i.e. flax), randomly arranged in a mixture of lime or cement mortar, will allow to produce plasters used to reduce the thermal dispersions through the building envelope and, at the same time, possible improvements of the structural/seismic behaviour of existing structures and materials will be evaluated. The research activities will be aimed at the physical-mechanical experimental characterization of the aforementioned plaster, as well as at the development of theoretical calculation methods for the estimation of its seismic behaviour.

In the second research line, retrofit systems of existing buildings under form of FRP and FRCM made of natural fibres, arranged to form meshes or grids, will be examined. Laboratory tests will initially be carried out aimed at the physical-mechanical characterization of the systems, at the definition of optimal bonding techniques and substrate and at the execution of shear and axial tests. The results obtained will allow to perform experimental tests on structural elements reinforced with these techniques and appropriate numerical models will be setup to calibrate the achieved results. Also, a LCA analysis will be developed to evaluate the energy impact of the implemented reinforcing systems on the environment during their whole life cycle.



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

For both systems under study, the final objective of the research path will be numerical analyses from energy and seismic viewpoints on a number of significant case studies, that will be developed to prove their effectiveness to improve the performance of existing buildings, also through an integrated evaluation approach.

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

- Ademovic, N., Formisano, A., Penazzato, L., Oliveira, D.V. (2022). Seismic and energy integrated retrofit of buildings: A critical review. *Frontiers in Built Environment*, 8, art. no. 963337. DOI: 10.3389/fbuil.2022.963337.
- Davino, A., Longobardi, G., Meglio, E., Dallari, A., Formisano, A. (2022). Seismic Energy Upgrading of an Existing Brick Masonry Building by a Cold-Formed Steel Envelope System. *Buildings*, 12 (11), art. no. 1918. DOI: 10.3390/buildings12111918.
- Formisano, A., Davino, A. (2022). Tensile Testing on Hemp Stems. *AIP Conference Proceedings*, 2425, art. no. 360003. DOI: 10.1063/5.0081413.
- Formisano, A., Davino, A. (2022). Experimental Investigation on Cement Mortar Bricks Manufactured with Fennel Wastes. *Buildings*, 12 (2), art. no. 230. DOI: 10.3390/buildings12020230
- Formisano, A., Vaiano, G., Petrucci, N.J. (2022). Hemp-FRP for Seismic Retrofitting of Existing Masonry Buildings. *Lecture Notes in Civil Engineering*, 209 LNCE, pp. 402-417. DOI: 10.1007/978-3-030-90788-4_33.
- Piccolo, A.P., Longobardi, G., Formisano, A. (2022). Seismic Vulnerability and Consolidation by FRP/FRCM Systems of a Masonry School Building in the District of Naples. *Buildings*, 12 (11), art. no. 2040. DOI: 10.3390/buildings12112040.
- Formisano, A., Chiumiento, G., Lautieri, E. (2020). Experimental tests on cement mortars manufactured with hemp flour. *Open Civil Engineering Journal*, 14 (1), pp. 302-313. DOI: 10.2174/1874149502014010302.
- Formisano, A., Dessì, E., Jr., Landolfo, R. (2017). Mechanical-physical experimental tests on lime mortars and bricks reinforced with hemp. *AIP Conference Proceedings*, 1906, art. no. 090006. DOI: 10.1063/1.5012363.
- Formisano, A., Fabbrocino, F., Dessì, E., Jr., Chiumiento, G. (2017). Experimental shear tests on tuff blocks triplets with hemp fibres reinforced lime mortar. *AIMETA 2017 - Proceedings of the 23rd Conference of the Italian Association of Theoretical and Applied Mechanics*, 2, pp. 2022-2028.



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

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 (<i>indicare Università/ente di ricerca e docente/ricercatore di riferimento con indirizzo mail</i>) (max 300 parole)
A minimum of three months will be spent by the PhD student at the University of Cergy-Pontoise (France) under the tutorage of Professor George Wardeh, who is working in the field of green materials. A further research period of at least three months could be spent at the University of Timisoara (Romania) under the guidance of Prof. Marius Mosoarca, who collaborated since many years with me in the field of seismic assessment of structures.

11. Eventuali collaborazioni con imprese/aziende sul tema di ricerca (max 300 parole)
The partnership with the Olympus Srl company, which has a consolidated background in the production and marketing of FRP and FRCM made of synthetic and natural systems, will allow to the PhD student to join together theoretical and practical approaches to implement new techniques based on natural fibres for consolidation of existing constructions.

Napoli, 30/06/2023

FIRMA