

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

XXXVII CICLO

Il sottoscritto prof. _____ANTONIO FORMISANO______

 $(PO \square PA \blacksquare RU \square RTD \square)$ afferente al Dipartimento di __STRUTTURE

PER L'INGEGNERIA E L'ARCHITETTURA_____

S.S.D. (ICAR/09 - TECNICA DELLE COSTRUZIONI)

CHIEDE

di essere inserito nell'elenco dei tutor per il XXXVII ciclo.

1. Curriculum 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 regualification of buildings. He is the author of more than 350 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 187, Citations: 2329, Hindex: 29 (updated on 07/10/21). 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



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of steel joints. Currently he is a member of the 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 2019, as published by Stanford University on Plos Biology.

2. Dottorandi dei quali il proponente è stato tutor nell'ultimo triennio	
п	specificare tipologia di borsa: ateneo, pon, por, ecc.

3. Titolo della ricerca proposta

Novel plasters reinforced with hemp fabrics and meshes for seismic retrofit and energy efficiency of existing buildings

4. Area Tematica

Ingegneria Geotecnica 🛛



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Ingegneria Strutturale

Rischio Sismico \Box

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

Hemp is a 100% biodegradable material and it is one of the most innovative natural products used to limit the amount of energy consumed both in the production phase of materials and during the life cycle of buildings. Among the various advantages of hemp, at an environmental level, the ability to combat climate change is emphasized. In fact, being a "carbon negative" material, hemp synthesizes carbon and reduces CO₂ emissions into the atmosphere, making healthier the environment where it is applied and drastically reducing polluting emissions caused by construction processes. In addition, hemp fibre fabrics and meshes can represent, like the most common synthetic materials (C-FRP, steel, etc.), an effective structural reinforcement system. Therefore, the use of hemp for plaster manufacturing has the dual objective of increasing energy efficiency and seismic behaviour of buildings. The prerogatives of the proposed systems make the project compliant with the following research areas and thematic areas of the art. 3 of the Ministerial Decree 1061/2021: 1) SNSI 2021-2027: - National thematic area: Smart and sustainable industry, energy and environment; 2) PNR 2021-2027: - Major field of research and innovation: Climate, Energy, Sustainable Mobility; - Related areas of intervention: Environmental Energy (Articulation 2. Regeneration and de-carbonization of the building stock).

The project proposal concerns the study of retrofit systems for existing buildings using plasters made of fabrics and meshes in hemp fibres. Laboratory tests will initially be conducted aimed at the physical-mechanical characterization of the systems, the definition of substrate and optimal bonding techniques and the execution of pull off and direct shear tests. The results obtained will allow to perform further experimental campaigns on structural elements reinforced with these techniques and numerical analysis on a wide range of existing buildings in order to evaluate the seismic-energy benefits deriving from the use of these reinforcement systems.

The final objective of the research proposal will be the implementation of appropriate mathematical formulations able to quantify the performance provided by the proposed systems for the packaging of fibre-reinforced plasters for retrofitting of existing buildings in both structural terms, through the introduction of corrective coefficients for estimating the performance increases of existing materials and members, and energy ones, through the definition of the physical parameter of thermal transmittance.



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6. Pubblicazioni sul tema di ricerca

- 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., Chiumiento, G., Dessì, E.J. (2020). Laboratory tests on hydraulic lime mortar reinforced with jute fibres. Open Civil Engineering Journal, 14 (1), pp. 152-162. DOI: 10.2174/1874149502014010152.
- Formisano, A., Chiumiento, G., Fabbrocino, F. (2020). Experimentation on lime mortars reinforced with jute fibres: Mixture workability and mechanical strengths. Lecture Notes in Mechanical Engineering, pp. 1869-1880. DOI: 10.1007/978-3-030- 41057-5_150.
- Formisano, A., Dessì, E.J., 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., Dessi, E.J., 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.

7. Progetti di ricerca finanziati in cui l'attività si inserisce

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8. Fondi disponibili per eventuali assegni, borse di ricerca, ecc., per acquisto eventuale di attrezzature, missioni

Some funds will be provided by the OLYMPUS SRL company.



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9. 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*) (max 300 parole)

A minimum of 3 months will be spent by the PhD student at the University of Mons (Belgium) under the tutorage of Professor Laurent Van Parys, who is working in the field of sustainable products for Civil Engineering. Prof. Van Parys already established a common research activity with my research group on this topic during my two short visits in Mons (June 2018 and October 2019) and also through the MsC Thesis of Miss Coline Cantineaux, who was two months in Naples in 2020 for developing her work in the framework of the Erasmus programme.

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

The research activity will be developed also in cooperation with the OLYMPUS SRL company, specialized in the field of innovative composite materials, who already performed in the past research and development projects in collaboration with universities and specialized research laboratories. The OLYMPUS SRL company, legally represented by Dr. Giuseppina Maio, has headquarter in Via Riviera di Chiaia, 118 in Naples and will host the PhD student for 6 months.

Napoli,__07/10/2021_____

FIRMA

Jutino Chu

Il presente modulo va compilato in ogni sua parte ed inviato all'indirizzo di posta elettronica <u>phd.dist@unina.it</u> entro e non oltre **venerdì 30/04/2020**.