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. **Elena Mele**

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

S.S.D. (*indicare codice e nome per esteso)* ICAR/09 Tecnica delle Costruzioni

CHIEDE

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

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1. Curriculum sintetico del proponente (max 500 parole)

2010 full professor, 2006-2010 associate professor, 1999-2006 assistant professor, University of Napoli Federico II, 1995-1997 post-doc research assistant, 1994 PhD in structural engineering.

Research activity:
Topics:
- generative design of megastructures, diagrid and gridshells;
- retrofit of existing buildings with exoskeleton;
- innovative structures for tall buildings;
- robustness and design for collapse prevention;
- seismic isolation at the base and intermediate level;
- tuned mass dampers;
- seismic assessment of masonry structures;
- seismic design of steel structural systems and connections;
- aluminium structures and foams.

Author of more than 260 publications in international and national journals and conference proceedings.

Since 2018 member of board of directors of Council of Steel Technicians (CTA), since 2018 member of Academic and Teaching Committee of Council of Tall Buildings and Urban Habitat, since 2017 fellow of Accademia delle Scienze d'Abbruzzo e delle Regioni Adriatiche, since 2015 member of Council of Tall Buildings and Urban Habitat.

2004 JSPS fellowship for Invited Visiting Professor at Disaster Prevention Research Institute, Kyoto University, Japan Society for Promotion of Science; 2001, 1999, 1998, 1996 visiting researcher at Instituto Superior Tecnico of Lisbon within FCT projects; 1999 visiting researcher at National Technical University of Athens, Laboratory for Earthquake Engineering, (ECOEST 2 - Access to Large Scale Facilities); 1999 visiting researcher at ELSA Laboratory of Joint Research Center, ISPRA.

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Member of the Editorial Board on the journals: Buildings, MDPI; Costruzioni Metalliche; Sustainability, MDPI. 2020 Reviewer for book proposals The Institution of Engineering and Technology (IET); 2017-2018 Engineering Structures award for outstanding contribution in reviewing; 2016-2017 Peer Reviewer of CTBUH document: Perfomance Based Seismic Design Guidelines of Tall Buildings; Reviewer for several international journals.

2022-2026: member of the steering committee of FreeGrid, a benchmark on design and optimization of gridshells to be launched at the IASS 2023 Annual Symposium in Melbourne (July 2023).
2022-2024 project DPC-ReLUIS, WP15. RU UNINA-DIST coordinator: Design code contributions on seismic isolation and energy dissipation – the Intermediate Isolation System (IIS).

Teaching activity:
Courses for undergraduate and graduate students at University of Napoli Federico II:
since 2004: Design of steel structures; since 2005: Structures for high-rise and long-span buildings; 2012-2015: Structural design of reinforced concrete buildings; 2001-2005: Tecnica delle Costruzioni II (advanced structural analysis and design).
2006-2015: International II level Master Design of Steel Structures in Smart Cities, University of Naples Federico II: course Structures for high-rise and long-span buildings, Lectures and student project tutoring in Atelier 2, member of executive committee and of the teaching board.
Since 2009: member of thesis-lab board, Engineering Architecture Course. University of Napoli Federico II. Tutor and reviewer of several thesis (around 10/year)
Since 2014 responsible of student internship in UK (AtelierOne) and USA (SOM San Francisco, Columbia University NY), 2021 responsible of student internship at Ufficio Regionale Genio Civile di Napoli.
Since 2001 tutor or co-tutor of 15 PhD students: 3 in Structural engineering, Geotechnics and Seismic Risk; 11 in Construction Engineering, 1 in Drawing and Representation in Architecture.
2016-2017 tutor of 1 post-doc from Cassino University research project funded by Regione Lazio POR FSR.

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

n. ___2__	*Mario Argenziano, Francesco Esposito*

3. Titolo della ricerca proposta

Reuse-based optimization approaches for environmentally efficient steel grid structures

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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.) □

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

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

The proposed project embraces the strategic emerging topic of Circular Economy, as applied at the Construction Industry sector, and in particular focusing on Structural Steelwork. The specific theme is the Reuse, i.e. the recovering and reusing materials coming from buildings, infrastructure, or constructions that have become obsolete or no more necessary. This approach is particular suitable for steel structures, since steel is a long-lasting material and the discrete (grid) structures can be easily disassembled, thus resulting in stocks of elements to be reused.

The main idea behind Re_Grid is to investigate the possibility of including reclaimed components into the optimal design of structures in order to reduce their environmental impact. To this purpose, the project aims at formulating an environmental integrated optimization approach that combines a weight-based optimization, controlled by the mechanical efficiency, and a reuse-based optimization, controlled by the environmental efficiency. Moving from the perspective of weight-based to reuse-based optimization, the mechanical efficiency of the grid topology reduces and the standardization of the structural solution increases. Research efforts are therefore necessary for proposing and testing procedures able to drive optimization towards different contemporary objectives.

The project focuses the study to the design of discrete steel structures, in particular gridshell canopies and diagrid exoskeletons, made by components dismantled from their original structural systems. The latter are defined by considering the steel typologies that in Italy/Europe can be deemed obsolete or that are about to be replaced in the near future, i.e.: pylons for electric lifelines, industrial sheds, space frames for roofs, etc.

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The project will be articulated into two main parts, a theoretical part and a demonstrative part; the former, devoted to the formulation of the environmental integrated optimization approach and referring to gridshells and diagrid exoskeleton structures; the latter, devoted to the application of the reuse-based approach to design of real case studies, by exploiting realistic inventories of structural components reclaimed from pylons, sheds, space frames.

The major result of the project is the new computational approach, appointed as environmental integrated optimization approach, able to address the so called "inverse-type" design and to account for both mechanical efficiency and reuse targets. Additional expected outcomes are: real, or likely, inventories of structural elements that can be proposed to designers for sustainable and environmentally efficient designs; set of reuse-based design guidelines, discussed and applied to real case studies, by exploiting the inventories of components reclaimed from Italian obsolete structures.

Therefore, the project will contribute to promote the principle of reuse, key aspect of circular economy, and to develop practical reuse-based optimization design tool.

References.

Brütting et al. Optimum Design of Frame Structures From a Stock of Reclaimed Elements, Front.BuiltEnviron. 6 (2020). https://doi.org/10.3389/FBUIL.2020.00057.

Brütting et al. Design and fabrication of a reusable kit of parts for diverse structures, Autom.Constr. 125 (2021). https://doi.org/10.1016/j.autcon.2021.103614.

Kuzmenko et al. Assessing environmental impact of digital fabrication and reuse of constructive systems, Structures. 31 (2021) https://doi.org/10.1016/j.istruc.2020.05.035.

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

L. Bruno, P. Cignoni, S. Gabriele, E. Grande, M. Imbimbo, F. Laccone, F. Marmo, E. Mele, L. Raffaele, V. Tomei, F. Venuti. 2023. FreeGrid: a benchmark on design and optimisation of free-edge gridshells. Proc. of the IASS Annual Symposium 2023. Integration of Design and Fabrication. Y.M. Xie, J. Burry, T.U. Lee and J. Ma (eds.). Melbourne, Australia, 10–14 July 2023.

V. Tomei, D. Faiella, F. Cascone, E. Mele. Structural grammar for design optimization of grid shell structures and diagrid tall buildings. Automation in Construction, 143 (2022) https://doi.org/10.1016/j.autcon.2022.104588

V. Tomei, D. Faiella, F. Cascone, E. Mele. 2022. Generative Design of Mega-Structures: A structural Grammar Approach. 5th International Conference for Structures & Architecture ICSA 2022, Aalborg (DK), 6-8 July 2022.

D. Faiella, M. Argenziano, F. Esposito, E. Mele. 2022. New life to old buildings in seismic area through structural steelwork. Proc. Congresso CTA 2022, XXVIII Congresso del Collegio dei Tecnici dell'Acciaio - Le giornate italiane della Costruzione in Acciaio. Pescara, Italy, 29 Sept. – 1 Oct 2022.

F. Cascone, D. Faiella, V. Tomei, E. Mele, Stress lines inspired structural patterns for tall buildings, Engineering Structures (2021) https://doi.org/10.1016/j.engstruct.2020.111546.

F. Cascone, D. Faiella, V. Tomei, E. Mele, A Structural Grammar Approach for the Generative Design of Diagrid-Like Structures, Buildings 11 (2021) https://doi.org/10.3390/BUILDINGS11030090V. Tomei, M. Imbimbo, E.

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Mele, Optimization of structural patterns for tall buildings: The case of diagrid, Engineering Structures 171 (2018) https://doi.org/10.1016/j.engstruct.2018.05.043.

D. Faiella, M. Argenziano, F. Esposito, E. Mele, Coupling of structural additions for the mitigation of seismic response in existing buildings, in: G.P. Cimellaro (Ed.), Seism. Isol. Energy Dissipation Act. Vib. Control Struct. 17th World Conf. Seism. Isol. (17WCSI), Springer, Lecture Notes in Civil Engineering, 309 (2023) pp. 632–642, https://doi.org/10.1007/978-3-031-21187-4_53.

E. Mele, M. Fraldi, G.M. Montuori, G. Perrella, V. Della Vista. Hexagrid-Voronoi transition in structural patterns for tall buildings. Frattura e Integrità Strutturale, 13 (2019) https://doi.org/10.3221/IGF-ESIS.47.15

D. Faiella, V. Faella, E. Alaio, E. Mele. 2019. Adeguamento sismico di edifici esistenti in c.a. tramite esoscheletro diagrid. Costruzioni Metalliche – Numero 5, Set/Ott. 2019, pp. 9-23.

D. D'Agostino, D. Faiella, E. Febbraro, E. Mele, F. Minichiello, J. Trimarco, Steel exoskeletons for integrated seismic/energy retrofit of existing buildings - general framework and case study, 2023 *submitted to Journal of Building Enineering.*

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

PRIN Bando 2022 PNRR: Re_Grid – Reuse-based optimization approach for environmentally efficient steel Grid structures. Prot. P2022LFW98 – **submitted, under review**

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

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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)

University of Kassel, Germany. Prof. M. Clobes

or

École Polytechnique Fédérale de Lausanne, Structural Exploration Lab, Switzerland. Prof. C. Fivet

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or

University of Stuttgart, Institute for Lightweight Structures and Conceptual Design, Germany. Prof. G. Senatore

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

EHS, Stuttgart, Germany

ArcelorMittal Steligence, Luxembourg, Luxembourg

AKT II, London, UK

SOM, San Francisco, USA

Napoli,30/06/2023

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.**