Supervisor Project Idea

Supervisor

Insert a brief CV and/or external link, the total number of publications, the ORCID link, 5 of the most significant/recent publications, and a list of funded projects and awards. Please indicate if you are a MSCA fellow yourself and if you have already been a MSCA Supervisor before. max 300 words

Francesco Clementi is Full Professor of Solids and Structural Mechanics at Università Politecnica delle Marche (UnivPM), Italy. Previously, Associate (2019-2024) and Assistant Professor (2012-2019), UnivPM. Reviewer for more than 90 journals, 10 International Conferences and 8 International Projects. Editorial Board member in 12 journals and 12 congresses, and organizer of more than 20 mini-symposia in International Congresses. He has been a lecturer in 8 summer/winter schools focusing on seismic vulnerability, structural consolidation of historical/monumental structures, and SHM (Structural Health Monitoring). He has developed research and teaching activities at the Universities of Ancona, Camerino, Lublin and Sao Paulo. Since 2019 he is member of Member of board of "Accademia Marchigiana di Scienze, Lettere ed Arti, Classe I". He was (2019-2021) Deputy manager of the Laboratorio Ufficiale Prove Materiali e Strutture of the Department of Civil and Building Engineering, and Architecture (DICEA), faculty of Engineering, UnivPM. He was (2021-2024) Member of the Board of the Italian Society of "Scienza delle Costruzioni" (Solids and Structural Mechanics) (SISCo). He is member/friends of the American Society of Mechanical Engineering (ASME) Technical Committee on "Dynamic and Control of Systems and Structures (DCSS)" since 2015. He was participant/coordinator in several national (Reluis MARS-CARTIS-UR33 UnivPM) and international projects (FP6, FP7, PRIN, Pompei Project, Cariverona, PNRR Vitality, etc.). He is the founder, majority shareholder, CEO, and technical director of the UnivPM spin-off "innovative Safe Dissipation Engineering srl (iSD Egineering)" which aims to spread seismic safety and structural control by combining dissipation and structural monitoring in a patent-pending dissipator. He is author of 73 scientific papers published on international journals indexed in scopus, and more than 100 scientific contributions published on conference (national and international) proceedings.
Francesco Clementi's expertise and research interests are focused on the field of Structural Engineering. He has recognized expertise in numerical modeling, non-destructive testing (NDT), and static and dynamic monitoring for the repair and maintenance of bridges, civil engineering structures, existing masonry (including monumental) buildings, and, more recently, trees.

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Main recent published papers:

1. Monchetti S., Viscardi C., Betti M., Clementi F., 2024, "Comparison between Bayesian updating and approximate Bayesian computation for model identification of masonry towers through dynamic data," Bulletin of Earthquake Engineering, DOI: 10.1007/s10518-023-01670-6.
2. Salachoris G. P., Standoli G., Betti M., Milani G., Clementi F., 2024, "Evolutionary numerical model for cultural heritage structures via genetic algorithms: a case study in central Italy," Bulletin of Earthquake Engineering, DOI: 10.1007/s10518-023-01615-z.
3. Giordano, E., Masciotta, M. G., Clementi, F., Ghiassi, B., 2023, "Numerical prediction of the mechanical behavior of TRM composites and TRM-strengthened masonry panels," Constr Build Mater, vol. 397, doi: 10.1016/j.conbuildmat.2023.132376.
4. Schiavoni M., Giordano E., Roscini F., Clementi F., 2023, "Advanced numerical insights for an effective seismic assessment of historical masonry aggregates," Engineering Structures, DOI: 10.1016/j.engstruct.2023.115997.
5. Bertolesi E., Buitrago M., Giordano E., Calderòn P.A., Moragues J.J., Clementi F., Adam J. M., 2020,"Effectiveness of textile reinforced mortar (TRM) materials in preventing seismic-induced damage in a U-shaped masonry structure submitted to pseudo-dynamic excitations," Construction and Building Materials, 248, DOI:10.1016/j.conbuildmat.2020.118532.

Research Group Description

Provide the name the reference department and a brief description of the research group, including external links, and available instrumentations and infrastructures. max 300 words

The group belongs to the Structures section, specifically the Structural Mechanics group, within the Department of Civil, Building, and Architecture Engineering (DICEA) at the Università Politecnica delle Marche. It is led by three full professors: Fabrizio Davì, the senior member and cornerstone of the team; Stefano Lenci, the scientific leader and visionary founder; and Francesco Clementi, a dynamic young full professor driving innovation. The team also includes four associate professors (Giovanni Lancioni, Michele Serpilli, Valeria Settimi, and Pierpaolo Belardinelli), as well as numerous PhD students and research fellows.
Additionally, Professor Clementi leads the spin-off iSD Engineering Srl, which features three partners (former PhD students) and a research fellow, showcasing the group's dedication to translating advanced research into practical, impactful solutions.

Topics

The Structural Mechanics group conducts cutting-edge research in theoretical and applied mechanics, exploring classical and innovative topics. Their work spans advanced materials, fracture mechanics, metamaterials, and structural optimization, integrating machine learning for predictive modeling and dynamic identification. They pioneer seismic vulnerability assessments, develop energy harvesting solutions, and design monitoring techniques for structural health. With expertise in nonlinear dynamics, computational mechanics, and thermo-mechanical behavior, the group tackles challenges from nanoscale materials to large-scale structures. Their mission is to revolutionize engineering practices, blending innovation, sustainability, and resilience to create safer, smarter, and more efficient structural systems for the future.

Infrastructures and instrumentations

The research group is equipped with state-of-the-art instrumentation for advanced dynamic testing of structures, both in the laboratory and on-site. This includes high-precision accelerometers, specialized hardware, and cutting-edge software tailored for structural analysis. Additionally, the group has privileged access to the university's Materials and Structure Testing Laboratory, a facility outfitted with next-generation tools such as hydraulic pumps, actuators, and reaction walls, enabling comprehensive static and dynamic testing under realistic conditions.
A key strength of the group lies in its computational capabilities: a high-performance cluster with two Dell GPUs supports the execution of extremely demanding numerical and analytical methods. This infrastructure allows the team to tackle complex scenarios with unparalleled precision, from large-scale finite element modeling to advanced simulations of structural behavior under dynamic loads.
Moreover, the group has extensive experience in real-world applications, having successfully installed numerous static and dynamic monitoring systems on existing structures. This unique combination of cutting-edge instrumentation, computational power, and practical expertise enables the group to address the most challenging problems in structural analysis and monitoring, driving innovation and pushing the boundaries of resilience and safety.

Web: https://dicea.univpm.it/en/thematic-sections/structural-mechanics/

Research thematic area

Indicate the MSCA panel and keywords that better describe your field of competence and research thematic area of your interest for a MSCA PF supervision – you may add extra keywords and text if necessary.

MSCA Panel Chemistry (CHE) - Economic sciences (ECO) - Information Sciences and Engineering (ENG) - Environmental and Geosciences (ENV) - Life Sciences (LS) - Mathematics (MAT) - Physics (PHY) - Social Sciences and Humanities (SOC)	**MSCA Keywords** MSCA Panels & Keywords.pdf Link documento	**Free keywords**	**Free text**
Information Science and Engineering (ENG)	G3-Products and Processes Engineering: Product design; Construction methods; civil engineering; material engineering.	Composites; Modelling; R.C.; Masonry; Cultural Heritage; SHM; Damage Detection; OMA.	

Contact details (*including email address of the supervisor*)

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Title and goals

Provide the title of the topic and a short summary if you already have a project idea.
Projects ideas can also be defined and discussed with potential candidates later.
max 200 words

SMART+: Beyond Traditional Retrofitting – Creating Structures that Sense, Respond, and Protect

The project envisions a groundbreaking leap in the seismic resilience of existing reinforced concrete (RC) and unreinforced masonry (URM) structures by merging advanced materials with intelligent monitoring technologies. The SMART+ approach introduces "living" retrofitting systems that not only strengthen structures but also sense, adapt, and respond to stress in real time. By embedding cutting-edge SHM technologies -such as optical fibers and miniaturized sensors- directly into high-performance composite materials like fiber-reinforced polymers (FRP) and textile-reinforced mortars (TRM), this project pioneers a dual-function solution that combines durability with intelligence.

Imagine structures that can "talk": reporting strain, detecting cracks, and predicting vulnerabilities before they become critical. This vision goes beyond conventional retrofitting by integrating artificial intelligence and digital twins, enabling continuous learning and optimization of structural performance over time. The project will validate these innovations through advanced simulations (FEM/DEM) and real-world testing, ensuring scalability, cost-effectiveness, and compatibility with both modern and heritage buildings.

SMART+ sets a new benchmark for sustainable cities, aligning with SDG 9 (Innovation and Infrastructure) and SDG 11 (Sustainable Communities). By turning passive structures into active systems, this initiative redefines resilience, offering a future where buildings are not just safer, but smarter and more sustainable—a true paradigm shift for civil engineering and urban living.