UNIVERSITÀ POLITECNICA DELLE MARCHE

Department of Construction and Civil Engineering and Architecture (DICEA)

February, 2024 - www.dicea.univpm.it

Supervisor short CV

Prof. **Fabrizio Gara** is full professor of Structural Engineering at the Department of Construction, Civil Engineering and Architecture (DICEA) of UnivPM.
He was teacher of Analysis and Design of R.C. and Steel Structures, Earthquake Engineering, Material and Structure Testing and Control, and Advanced Structural System; now he teaches Structural Rehabilitation, Structural Engineering, and Design of Bridges.

Research topics
Analysis and modelling of steel-concrete composite bridges, soil-structure dynamic interaction for seismic design of pile foundations and superstructures, dynamic characterization of buildings and bridges through dynamic testing and ambient vibration measurements, seismic and structural health monitoring.

Publications
He is author of numerous scientific papers, also with international co-authors, published on International Journals (55 papers, 42 of them in 1st quartile journals) and presented at International Conferences (more than 110 papers).
ORCID: https://orcid.org/0000-0003-1272-0673

Italian and European main research projects
Scientific Coordinator for the UnivPM unit within the 2019-2021 and 2022-2024 ReLUIS projects (lines WP4-9, WP6-2, WP12-4) about risks, monitoring and assessment of bridges.
Principal Investigator of the Cariverona national research project "PROTECT - maPping the seismic Risk Of straTEgiC consTructions".
UnivPM unit coordinator within two European projects: SERA 2019 ("DYMOBRIS - DYnamic identification and MOnitoring of scoured BRIdgeS under earthquake hazard") and ERIES 2022 ("ERIES- SCOUR&SHAKE - Structural Performance monitoring and evaluation of scoured bridges under dynamic actions").

Members of the research group

- Prof. Eng. Fabrizio Gara (Full Professor)
- Prof. Eng. Sandro Carbonari (Associate Professor)
- Prof. Eng. Laura Ragni (Associate Professor)
- 2 post-doc fellows
- 3 PhD students
- 1 MSc research fellowships

Topics

The research group has many years of research experience on bridges, which includes theoretical studies, analytical and numerical modelling, construction processes and design of new bridges, with particular focus on steel-concrete composite bridges. The group has also deep experience on existing bridges, and is actually involved in on-site inspections, testing, and assessment of the bridge structural performance following new code procedures. The group also has well-established and extensive experience in static and dynamic testing of both laboratory mock-ups and real structures tested in situ, and in static, dynamic and seismic monitoring of bridges and buildings in general.

Moreover, the research group is involved in research activities relevant to the soil-structure interaction and the structural seismic protection through base isolation and dissipative devices; these topics are addressed especially in the topic of bridges.

Instrumentation and infrastructure

High-quality instrumentation for performing dynamic tests on structures (shakers, instrumented hammer, accelerometers, dedicated hardware and software), both on laboratory and on-site.

Possibility to use the Materials and Structure Testing Laboratory of the UnivPM, equipped with many facilities (e.g., hydraulic pump, actuators and reaction walls for static and dynamic testing).

Availability of data from many static and dynamic monitoring systems already installed on real structures (1 bridge, 1 heritage church, 1 strategic tower building, 19 residential buildings).

Instrumentation

Monitoring
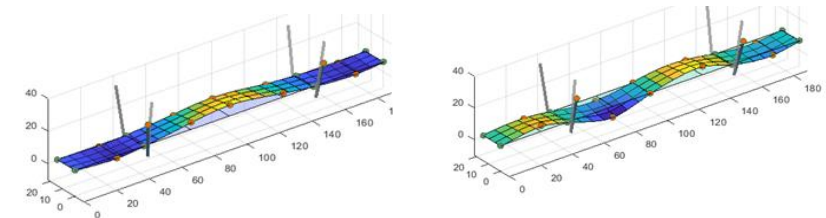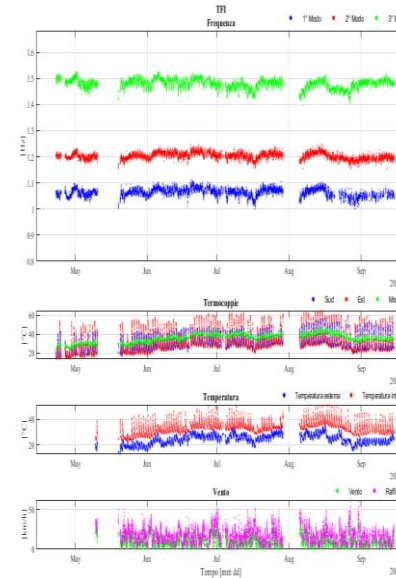
UNIVERSITÀ POLITECNICA DELLE MARCHE

The Department of Construction, Civil Engineering and Architecture (DICEA) is among the mostly active departments of construction and civil engineering, as well as, architecture, in Italy, generating (*research*) and transferring (*training*) knowledge and value of the highest quality on such topics.

DICEA is arranged in 4 main sections: Architecture, Constructions, Infrastructures and Structures.

DICEA was ranked first in 2017 among the best University departments of Italy (Department of Excellence) and awarded with a grant of 6,6 M€ in the period 2018-2022. In 2022 the DICEA was again ranked first and then awarded with a new Department of Excellence grant (about 6,5 M€) for the period 2023-2027.

DICEA brings together a wide range of disciplines, being leading contributor to the undergraduate programmes in civil and environmental engineering, building engineering, architectural engineering. DICEA also offers postgraduate programmes in civil, environmental, building engineering and architecture.

In the last 5 years, DICEA gathered resources >23 M€ (about 1M€/y from the third mission), of which: 2 EU HE MSCA-DN, 2 EU Interreg, 1 EU Internal Security Fund, 1 EU LIFE, 3 EU Erasmus+, 1 USA DoD and 9 National projects of Relevant Interest.

Coherently with the current global challenges, DICEA has individuated 4 main development axes for the next 5 years: Heritage Science; Safety of structures, infrastructures and natural systems; Digital management of constructions and built environments; Climate change, and constructions and transportation sustainability.

https://www.dicea.univpm.it/

AT A GLANCE

2023

15 Scientific Area
ICAR 01, ICAR 02, ICAR 04,
ICAR 06, ICAR 08, ICAR 09,
ICAR 10, ICAR 11, ICAR 14,
ICAR 17, ICAR 18, ICAR 19,
ICAR 21,
MAT 05, IUS 07

229 Publications

72 Staff

>2.7 mln € Research income

71 PhD, Post-doc, Research fellows

Teaching programs for FIRST CYCLE DEGREE (Building Engineering, Civil and Environmental Engineering), PROFESSIONAL DEGREE COURSE (Technics for Territorial Design and Management), MASTER DEGREE (Civil Engineering, Building Engineering, Environmental Engineering) & SINGLE CYCLE DEGREE (Building Engineering-Architecture)
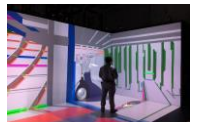
Department of Excellence (from Italian National Agency for the Evaluation of Universities and Research Institutes)
- 2018-2022
- 2023- 2027

Research laboratories **9**

1 Digital Education Lab

Structural Health Assessment of Bridges during and after FLOOD events (FLOOD-SHAB)

The proposed action "Structural Health Assessment of Bridges during and after FLOOD events" (FLOOD-SHAB) aims to investigate the structural behaviour of critical infrastructures such as bridges, focusing on the studying and assessing the structural response of bridges during and after flood events. The main objective is to improve the understanding of bridge structural behaviour under various health conditions and enhance the capacity to detect structural damage caused by component failure or foundation scouring.

Climate changes increasingly impact our life. Climate has become less predictable. Droughts, floods, and new temperature records are becoming more common worldwide, including in Europe. The rising global temperature intensifies the water cycle, which increases wet and dry extremes and affects the critical infrastructure essential for the functioning of a society and economy. Bridges are vital in transportation networks, enabling people, vehicles, and goods to move over rivers and other obstacles. Bridges are also necessary for allowing access to essential services such as healthcare, emergency response, education, and employment. Due to their significance, bridges need protection from potential hazards, including natural disasters and ageing. Flooding can significantly impact bridges. The increased water levels result in the additional force from fast-moving water, which can lead to structural damage, and scouring of bridge foundations. Regular inspections, continuous structural health monitoring (SHM) (especially during flood events), and maintenance programs are vital to ensure bridges' structural integrity and safety.

Project objectives

- Data collection by SHM systems installed on-site case studies

- Data analysis and interpretation, defining feature thresholds of the bridge's unsafe condition