



**POLITECNICO**  
MILANO 1863

## **Supervisor Expression of Interest MSCA - Marie Sklodowska Curie Action - (PF) Postdoctoral Fellowship 2024**

**Supervisor name:** Giovanni Muciaccia

**Email address:** [giovanni.muciaccia@polimi.it](mailto:giovanni.muciaccia@polimi.it)

**Link “Pagina docente”:** [muciaccia.faculty.polimi.it](http://muciaccia.faculty.polimi.it)

**Department Name:** Civil and Environmental Engineering

**Research topic:** Fastening and Sustainability in Constructions

### **MSCA-PF Research Area Panels:**

- ECO\_Economic Sciences
- ENG\_Information Science and Engineering
- ENV\_Environmental and Geosciences
- LIF\_Life Sciences
- MAT\_Mathematics
- PHY\_Physics
- SOC\_Social Sciences and Humanities
- CHE\_Chemistry

### **Brief description of the Department and Research Group:**

Besides the Principal Investigator, the Research Team currently counts on 2 research assistants (post-docs), 6 PhD students and 2 additional visiting PhD students. All the activities in the team are carried out in close relationship with the industrial and professional sectors. The team can also count on intense cooperation with international research groups (at UGent, IWB Stuttgart, CSTB, Purdue University, TU Dortmund).

The basic and applied research, as well as the product development activities have a strong experimental basis. R&D in the specific field of seismic behavior of fastening to concrete represents one of the key specializations of the group at international level.

In structural engineering the final impact of any research is in the structural code development, where the group is significant active (Eurocodes 2, 5, 8, *fib* Model Code 2020, ACI 216, 355, 408). The continuous exchange with the industrial and professional sectors allows to establish a virtuous circle where, on one side, it is possible to provide an operative answer to industrial or professional needs while, on the other, there is a clear perspective for new ideas and concepts developed by the team.



**POLITECNICO**  
MILANO 1863

During the last 10 years, the group cooperated with more than 20 industrial companies in Europe (S.M.E., large companies or governmental agencies) to develop specific fastening solutions for structures in concrete or timber, collecting more than 4M€ in funding and service testing.

More relevant project where the supervisor acted as Coordinator are:

- *Électricité de France (EDF, France)* – i) Mono studs plates P200; ii) EPR screwed head systems anchors; iii) Innovative screwed plate systems; iv) A new linear anchorage system.
- *European Consortium of Anchors Producers (ECAP, Italy)* – i) Behavior of bonded anchors under sustained loading; ii) Corrosion of fasteners in concrete and masonry; iii) Behavior of bonded anchors in seawater environment; iv) Behavior of connections in timber-concrete composite structures.
- *Danieli (Italy)* - Dimensioning and mechanical behavior of anchor systems;
- *Fischer (Germany)* - Innovative low-carbon solutions for sustainable seismic retrofitting of existing masonry buildings;
- *Friulsider (Italy)* – i) Optimization of hold-down connectors for timber structures; ii) Optimization of planar connectors for timber structures.
- *IEA Ingenieurburo (Germany)* - Full scale testing of an innovative FFHRS for beam-column joints;
- *ITW Construction (Italy)* - Development of the Trider fastener for use both in concrete and masonry under quasi-static action;
- *Scintilla AG (Switzerland)* - Effect of drilling procedures with special drill bits on the behavior of bonded anchors;
- *Spit (France)* - Behavior of plastic anchors for fixing façade claddings through angle brackets in masonry and concrete under seismic action.

Additionally, in the framework of the Italian National Plan of Recovery and Resilience, the supervisor is Co-Pi in MUSA- Multilayered Urban Sustainability Action (2022-2026)- Spoke 3, dealing with 3Dprinting/additive manufacturing.

**TITLE of the project:** A holistic approach to establish coupled structural and environmental performances of fastening systems in civil structures

**Brief project description:**

Both in new constructions and in the refurbishment of existing buildings there is a great use of fastening systems.

Fastening systems are essential to connect structural elements and to support non-structural parts of the building to which mechanical performances are required to safeguard human life and to guarantee the functioning of the building in particular conditions.

In retrofitting, specifically, for obvious reasons the connections must be formed using post-installed solutions such as post-installed fastenings (anchorages), post-installed reinforcing bars, screws, gluing to concrete or timber.

The environmental impact of fastening systems is considerable because fasteners are many and are spread everywhere in buildings and they are mostly made out of non-recycled material, nor follow a consolidated path of sustainable production processes, being production mostly located in the Far East.



**POLITECNICO**  
MILANO 1863

Fasteners are not conceived to be recycled in a construction demolition process with a total lack of indicators of the environmental impact of these products, and also of a specific circular economy model for the fasteners sector.

Marketing policies are steering R&D toward a constant increase in structural performances in terms e.g. of strength or stiffness without any specific insight regarding the effective need of such performance in daily applications nor any interest in defining true impact indicators for fastening systems, besides simple Environmental Product Declarations, if any.

Research needs to address which are the possibilities of recovery and / or reuse of the products, partially or totally or, even more in general, if recovery is possible and to which costs in terms of environmental impact. To achieve the goal, possibility to migrate towards alternative materials compared to the traditional ones should also be explored.

It is also asked if digital technologies for tracking, tracing and mapping may provide a support.

The final goal would consist in establishing a circular economic model for fasteners and fastening systems reconsidering the concept of fasteners performance in construction, currently strongly based on marketing needs, rather than on actual design needs, also by introducing breakthrough innovations in the design of the fastener conceived for recycling or reuse. In a few words, the project aims to define a new framework to design for performance, serviceability, circularity, disassembling and reassembling in a holistic approach which will involve concepts, approaches and tools of structural analysis, life-cycle analysis, and digitalization.