CIVIL AND ENVIRONMENTAL ENGINEERING

AMMIN/DAD - Sustainable and Energy-Efficient Structural Retrofitting for Nearly-Zero Constructions

Funded By	Politecnico di TORINO [P.iva/CF:00518460019] Dipartimento DAD
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Context of the research activity	This research is co-funded by «REtrofitting Historic Architecture foR Zero Emissions (REHARZE)» project – funded by Ministero dell'Università e della Ricerca within the PRIN 2022 program (D.D. 104 del 02-02-2022 Ministero dell'Università e della Ricerca), CUP: E53C24002840006. The growing concern about sustainability in our communities is highlighting the importance of the rehabilitation of existing structures as a crucial strategy for preserving built heritage and reducing the carbon footprint of new constructions. In this context, enhancing the structural retrofitting systems and techniques with energy-efficient solutions is an emerging challenge for the industry and the scientific community. This research will focus on the analysis of sustainable and energy-efficient structural retrofitting systems for nearly-zero buildings. The activities will include the design, testing and modelling of novel composite materials for the integrated structural and energy retrofitting of existing constructions by means of enhanced Textile Reinforced Matrix (TRM) systems.
Objectives	The candidate will work on the experimental validation of the novel strengthening system and the development of digital models to simulate the stress- and heat-transfer mechanisms within the material's components, as well as the interaction with the strengthened structure. The ultimate goal is to propose and validate the effectiveness of novel sustainable composite systems for the structural rehabilitation of buildings, which integrate mechanical efficiency, enabling latent Thermal Energy Storage (TES) and release, thereby significantly reducing the energy demand from conventional sources towards nearly zero energy buildings. The main foreseen tasks and duties can be summarized in the following points: - Review the current state-of-the-art on TES in structural applications; - Design novel energy-enhanced composite materials for the retrofitting of existing buildings with structural deficiencies; - Experimentally characterize the mechanical and thermophysical properties

	of the novel systems; - Develop numerical models to gain insights into the mechanisms governing the energy-enhanced composite material and its interaction with the strengthened structure.

Skills and competencies for the development of the activity	- Fundamentals of Structural Mechanics and/or Thermal Energy Storage; - Skills in experimental methods for material characterisation; - Skills in numerical simulation and programming.