ROMA TRE UNIVERSITÀ DEGLI STUDI

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DEPARTMENT OF CIVIL, COMPUTER AND AERONAUTICAL ENGINEERING
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MSc Course in Civil Engineering for natural risk protection
Laurea Magistrale in ingegneria Civile per la protezione dai rischi naturali

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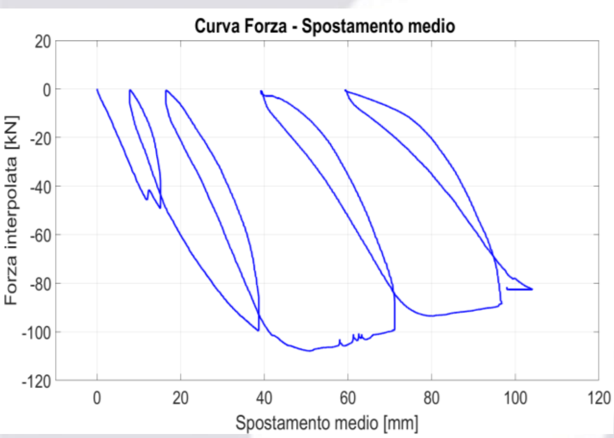
Laboratory tests on the shear behavior of reinforced concrete beams subjected to monotonic and cyclic loads

Motivations and aims

The motivation behind this research lies in the structural relevance of shear behaviour in reinforced concrete beams, particularly due to its potential to cause sudden and brittle failures. Real-life structures are subjected to complex conditions involving geometry, material variability, and different types of loading, which are not always fully addressed by current design codes. This study aims to investigate shear response through a comparative experimental approach under monotonic and cyclic loads. The goal is to analyze crack patterns, evaluate structural performance, and provide empirical data that may support the refinement of verification methods and enhance the assessment of existing structures.

Methods and results



The experimental campaign involved two full-scale reinforced concrete beams with inverted T-shaped sections, tested under monotonic and cyclic loading. Both beams were simply supported with a cantilever and designed to fail in shear. Prior to testing, steel and concrete were mechanically characterized. Displacements were monitored using LVDT transducers, with data collected via a LabView system. The monotonic test involved a slow continuous load, while the cyclic test applied nine load-unload cycles. The results revealed notable differences in shear crack development, emphasizing the effect of cyclic loading on crack propagation and structural performance.

Conclusions and future developments

The experimental results confirmed that shear behaviour in reinforced concrete beams is significantly influenced by the type of loading. Monotonic and cyclic tests revealed clear differences in crack formation, propagation, and failure mechanisms. Cyclic loading led to a more distributed and progressive damage pattern, highlighting the importance of considering this type of action in design and assessment. The combination of precise displacement monitoring and visual tracking of crack evolution provided valuable insights into the structural response.