ROMA TRE UNIVERSITÀ DEGLI STUDI

ROMA TRE UNIVERSITY
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

MSc Degree Thesis
Tesi di Laurea Magistrale

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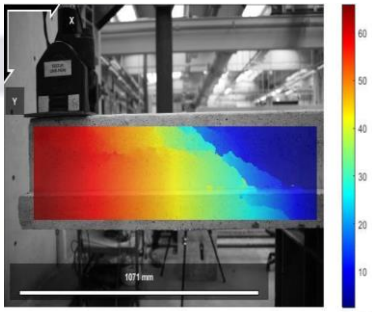
Experimental investigation on the shear behaviour of RC beams with the application of DIC for the measurement of the displacement field

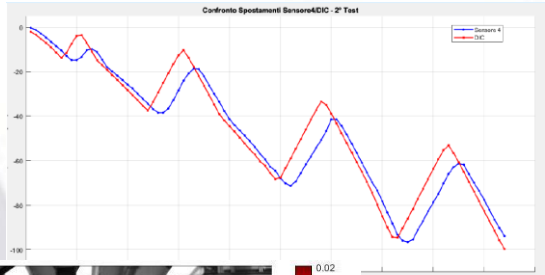
Motivations and aims

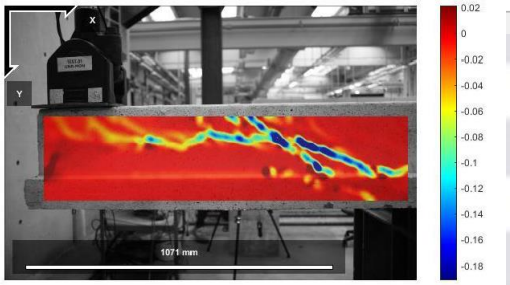
The experimental investigation featured two tests on reinforced concrete beams. These structural elements were designed to induce shear failure on the beam cantilever. The test setup included two supports and a cantilever that was loaded by a force exerted by a hydraulic jack. Another distinctive aspect of this study was the Digital Image Correlation monitoring technique used to calculate the beam's displacements and deformations. The values of these parameters were compared with the corresponding values returned by LVDT transducers.

Methods and results



The Digital Image Correlation monitoring technique is a non-invasive optical technique that allows to obtain displacements and deformations. In this thesis, DIC was used to study the shear behavior of the beam cantilever. The preparatory activities for the analysis involved creating the speckle pattern on the specimen and setting the cameras for image acquisition. These images were subjected to correlation algorithms that provided the final result, the displacement field and the strain field. In these correlation algorithms, the parameter setting phase (subset radius, subset spacing, iteration number, norm of the difference vector) and the positioning of the seed resulted very important.





Conclusions and future developments

Comparisons were made between the mean displacements obtained via DIC in the section corresponding to the jack and the displacements returned by LVDT sensors positioned at the same section. This comparison resulted in a maximum percentage error of <10% for all cases analyzed. DIC was also used to produce graphs of the shear deformations, which were overlaid on the corresponding crack patterns to assess any correspondences. Indeed, this overlay revealed a certain similarity between the maximum deformation values and the trend of the most significant cracks/openings. All these results and data provided a good basis for a subsequent comparison with the results from experimental tests on reinforced concrete beams