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Investigation on Behaviour of Reinforced Concrete Beam-Column Joints Retrofitted with CFRP

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Abstract : The aim of this thesis is to provide numerical analyses of reinforced concrete beams-column joints with/without CFRP (Carbon Fiber Reinforced Polymer) in order to achieve a better understanding of the behaviour of strengthened beamcolumn joints. A comprehensive literature survey prior to this study revealed that published studies are limited to a handful only; the results are inconclusive and some are even contradictory. Therefore in order to improve on this situation, following that review, a numerical study was designed and performed as presented in this thesis. For the numerical study, dimensions, end supports, and characteristics of the beam and column models were the same as those chosen in an experimental investigation performed previously where ten beamcolumn joint were tested tofailure. Finite element analysis is a useful tool in cases where analytical methods are not capable of solving the problem due to the complexities associated with the problem. The cyclic behaviour of FRP strengthened reinforced concrete beam-columns joints is such a case. Interaction of steel (longitudinal and stirrups), concrete and FRP, yielding of steel bars and stirrups, cracking of concrete, the redistribution of stresses as some elements unload due to crushing or yielding and the confinement of concrete due to the presence of FRP are some of the issues that introduce the complexities into the problem.Numerical solutions, however, can provide further in formation about the behaviour in lieu of the costly experiments or complex closed form solutions. This thesis presents the results of a numerical study on beam-column joints subjected to cyclic loads that are strengthened with CFRP wraps or strrips in a variety of configurations. The analyses are performed by Abaqus finite element program and are calibrated with the experiments. A range of issues in beam-column joints including the cracking load, the ultimate load, lateral load-displacement curves of joints, are investigated.The numerical results for different configurations of strengthening are compared. Finally, the computed numerical results are compared with those obtained from experiments. the cracking load, the ultimate load, lateral load-displacement curves obtained from numerical analysis for all joints were in very good agreement with the corresponding experimental ones.The results obtained from the numerical analysis in most cases implies that this method is conservative and therefore can be used in design applications with confidence.

Keywords : numerical analysis, strengthening, CFRP, reinforced concrete joints
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