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Impact Behaviour of RC Beam Using Lattice Model with Discrete Representations of Reinforcements

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Extended Abstract

Concrete structures are subjected to various types of impact loads both in fabrication and maintenance stages [1]. There have been performed various studies on the impact behaviour of reinforced concrete (RC) beams in experimental [2]-[4] and numerical [3]-[7] areas. For simulations, it have been developed irregular lattice typed dynamic models for simulating failure behaviour of concrete and RC structures under high loading rates [5]-[7]. In the model, meshes for concrete are discretized by Delaunay/Voronoi dual tessellations [8]. Due to the rate dependency of concrete on mechanical properties and failure modes, it is required to reflect the rate sensitive characteristics into the numerical models. Therefore, a rheological unit with a combination of springs and dashpots is introduced into the rigid-body-spring elements [5]-[7]. For dynamic analysis, the mechanical responses of the RC beams are calculated from an explicit time integration scheme. The reinforcing bars are modelled as a discrete representation of each reinforcing elements in a given geometry. Previously, two-dimensional semi-discrete reinforcing elements were developed and validated in dynamic analysis [5], which is expended to three-dimensional case, in this study, assuming the perfect bonding in concrete-reinforcing bar interface. Thereafter, as a validation, the simulations on the impact behaviour of RC beams are conducted based on the experiments [3]. The simulated failure modes are shown to be in agreements with the experimental results. Based on this study, it will be continued the validation works through various benchmark examples in experimental and numerical works. Also, the influence of the bar distributions and reinforcement ratio on the failure behaviour of RC beams will be analysed for enhancing the impact-resistance design process of RC beams.

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