Modelling reinforced concrete structures subjected to impulsive loading using concrete lattice model

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ABSTRACT

A two-dimensional behavioral rate dependent lattice model (RDLM) capable of analyzing reinforced concrete members subjected to impulsive loading is presented. As a result of the impulsive loads reaching their peak intensity in extremely short durations of time, material nonlinearities and strain rate effects play an important role in the analysis. A numerical approach based on an explicit finite element formulation is introduced to solve two-dimensional planar structural problems under impulsive loads. The procedure incorporates equilibrium and compatibility conditions and utilizes realistic rate dependent stress-strain relationships for cracked concrete. The model inherently takes into account some major influencing factors, progressive cracking of concrete in tension, the inelastic response in compression, the yielding of reinforcing steel, and strain rate sensitivity of concrete and steel. Correlation studies between analytical and experimental results on reinforced concrete beams subject to impulsive loading are conducted and are shown to be in good agreement.