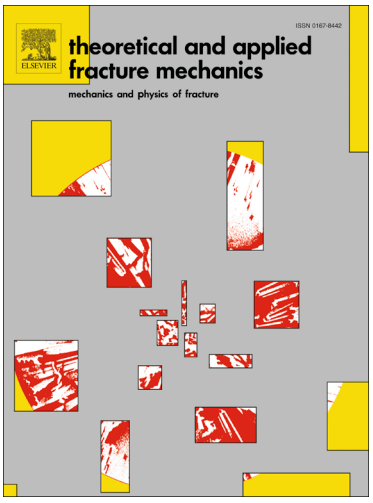

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Multi-linear Stress-crack Separation Relationship for Steel Fiber Reinforced Concrete: Analytical Framework and Experimental Evaluation

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Abstract

An experimental evaluation of the cracking and the post-cracking behavior in the steel fiber reinforced concrete (SFRC) beams using the displacement field obtained from digital image correlation (DIC) is presented. The physical basis of the hinge-type behavior in flexure is established from an analysis of the displacement discontinuity across the crack. In SFRC beams, the load recovery following the localization of strain to a single crack is shown to be associated with opening of the hinge. An analytical framework for implementing a multi-linear stress-crack separation (σ-w) relationship within the cracked hinge model is presented. Multi-linear σ-w relations are obtained for SFRC with different fiber volumes as a percentage of volume of concrete (V_f) by an inversion procedure. The σ-w relationship for SFRC exhibits an initial softening to values lower than the tensile strength which is followed by a stress recovery with increasing crack separation. In SFRC, the stress attains a constant value with increasing crack separation, larger than 1 mm. For V_f equal to 0.75%, application of cracked hinge model predicts a constant stress of magnitude less than the tensile strength with increasing crack separation in the part of the load response associated with multiple cracking.

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