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MICROMECHANICS BASED MODELLING OF FIBRE REINFORCED CEMENTITIOUS COMPOSITES

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A constitutive model for fibre reinforced cementitious composites based on continuum micromechanics solutions is presented. The model assumes a two-phase elastic composite, derived from an Eshelby solution and the Mori-Tanaka scheme [1], which comprises a matrix phase representing the mortar and spherical inclusions representing the coarse aggregate particles. Additionally, circular microcracks with various orientations are distributed within the matrix phase. An exterior point Eshelby based criterion is employed to model crack-initiation in the matrix-inclusion interface. Microcrack surfaces are assumed to be rough and able to regain contact under both normal and shear displacements. Once cracks start to develop, the crack-bridging action of fibres is simulated using a local constitutive equation that accounts for the debonding and pull-out of fibres with different orientations [2]. It is shown that the combination of the rough microcrack and fibre-bridging sub-models allows microcracking behaviour deriving from both tensile and compressive loads to be modelled in a unified manner.

Numerical results obtained with the proposed micromechanical constitutive model are compared with experimental data. Good correlation between numerical and experimental responses demonstrates the potential of the model to capture key characteristics of the mechanical behaviour of fibre reinforced cementitious composites.

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