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Coupling Between Progressive Damage and Permeability of Concrete

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In damage models, damage D and the reduction of elastic stiffness of a quasi-brittle material are strictly connected. Experimentally a good correlation between the evolution of damage and permeability K of concrete is also observed. Supposing that concrete is a disordered material, which can be simulated with the help of a discrete lattice model, the correlation between K and D can be analyzed theoretically. The relationship between the mechanical parameters of a fully disordered material and microcracking has been investigated. It has been shown that microcracking in lattices must be described by a degradation of stiffness if a scale independent representation is sought. In this paper we extend such a model to the analysis of a coupled hydro-mechanical problem. We observe that permeability is the size independent variable and is strongly correlated with the degradation of stiffness. Additionally, the evolution of permeability with mechanical damage and with stress ratio at pre-peak phase are studied and compared with experimental results.

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