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Multi-scale peridynamic modeling of dynamic fracture in concrete CHRISTOPHER LAMMI, MIN ZHOU, Georgia Institute of Technology, DYNAMIC PROPERTIES RESEARCH LAB TEAM — Peridynamics simulations of the dynamic deformation and failure of high-performance concrete are performed at the meso-scale. A pressure-dependent, peridynamic plasticity model and failure criteria are used to capture pressure-sensitive granular flow and fracture. The meso-scale framework explicitly resolves reinforcing phases, pores, and intrinsic flaws. A novel scaling approach is formulated to inform the engineering-scale plasticity model parameters with meso-scale simulation results. The effects of composition, porosity, and fracture energy at the meso-scale on the engineering-scale impact resistance are assessed. The fracture process zone at the meso-scale is found to propagate along adjacent pores and reinforcing phases under tensile and shear loading conditions. The simulations show that tensile strength decreases and dissipation increases as the porosity in the concrete increases. The framework and modeling approach allow the delineation of trends that can be used to design more impact-resistant materials.

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