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A High-Pressure Hish Strain Rate Elastic-Viscoplastic Model for Cementitious Materials

Martin J. Schmidt[(1)], Oana Cazacu[(2)], Mark L. Green[(1)], Nicolaie D. Cristescu[(3)]

(1) *Air Force Research Laboratory, Eglin, USA*
(2) *Graduate Engineering and Research Center, University of Florida, Shalimar, USA*
(3) *Mechanical and Aerospace Engineering, University of Florida, Gainesville, USA*

A comprehensive experimental study aimed at characterization of the combined effects of high confinement and high strain rate on the deformation and strength of cementitious materials was conducted. Quasi-static triaxial compression tests for confining pressures ranging from 0 to 500 MPa were performed. Dynamic tests for strain rates in the range 60/s to 160/s under unconfined and confined conditions were conducted using a split Hopkinson pressure bar. A decrease in strain rate sensitivity with increasing confining pressure was observed. A new elastic/viscoplastic model that captures compressibility, dilatancy, and strain rate effects has been developed for concrete. There are no a priori limitations or restrictions regarding the specific expressions of the yield function and viscoplastic potential. A new flow rule was proposed. Procedures for determining the constitutive functions were developed. Comparisons between model predictions and data showed the proposed model describes with very good accuracy the high-pressure behavior of concrete.

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