# Characterization of the uncertainties in the constitutive behavior of carbon nanotube/cement composites

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Lai Yin Chan and Bassem Andrawes
Department of Civil and Environmental Engineering, Newmark Civil and Environmental Engineering Laboratory, Universiy of Illinois at Urbana-Champaign, Urbana, IL 61801, USA
E-mail: andrawes@illinois.edu

**Abstract.** This paper addresses the uncertainties associated with using carbon nanotubes (CNTs) as reinforcement for cement. These uncertainties emerge mainly from the CNTs' wide range of mechanical properties and their interfacial behavior with cement. This study sheds light on the basis of choosing the optimal combinations of CNTs mechanical and interfacial parameters to improve the structural strength and ductility of CNT-reinforced cementitious composites. The finite element method (FEM) is employed to study the individual and interactive effects of five parameters, including interfacial shear (bond) strength, allowable slip, CNT Young's modulus, residual bond stress and aspect ratio. Numerical results show that the parameters, at certain ranges of values, interact substantially and greatly alter the mechanical properties of the composite. It is also found that the governing parameter is the CNT Young's modulus, which determines whether the composite is ductility critical or strength critical. Furthermore, the level of residual bond stress substantially influences the effect of other parameters, especially in the case of composite ductility.

*Keywords:* carbon nanotubes, cementitious composite, bond strength, ductility

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