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Stochastic multiscale modeling and simulation framework for concrete

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Abstract

In this paper we present a computational framework for generating a realistic representative volume element of concrete, which reflects its inherent structural randomness. Computed tomography (CT) images are employed to provide the necessary information for the geometric statistical characterization of aggregate and defect (voids, pores, and micro-cracks) distributions. A Monte-Carlo simulation is used to generate 1000 realizations of statistically equivalent representative volume element (SERVE) and finite element predictions of SERVEs elastic and inelastic response are compared with experiments.

Keywords: Concrete, Composite materials, Random heterogeneous materials, Statistically equivalent representative volume element

1. Introduction

Favorable mechanical properties, such as high compression strength, low thermal expansion, and durability, combined with design flexibility and accessible raw materials, are only several of the reasons for the wide use of concrete. Understanding the mechanical behavior of concrete has always been of utmost interest, both in industry and academia, which prompted intensive studies in search of accurate and realistic modeling of these materials. While mechanical

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