Delft University of Technology

Aerospace Structures & Computational Mechanics
Seminar Series

Dr. Huy Do

Modeling Properties of Cement Paste from Microstructure: Porosity, Mechanical Properties, Creep and Shrinkage

Autogenous shrinkage can be important in high-performance concrete characterized by low water to cement ratios. The occurrence of this phenomenon during the first few days of hardening may result in early-age cracking in concrete structures. Although the scientific community has reached a fair level of agreement on the basic mechanisms and standard test methods, the prediction of autogenous shrinkage is still a very challenging task. Good prediction of autogenous shrinkage is necessary to achieve better understanding of the mechanisms and the deployment of effective measures to prevent early-age cracking.

The aim of this study was to develop a numerical, micromechanical model to predict the evolution of autogenous shrinkage of hydrating cement paste at early age. The model was based on the three-dimensional hydration model ***µic*** of microstructure and the mechanism of capillary tension to simulate macroscopic autogenous shrinkage. Pore-size distribution and Mercury Intrusion Porosimetry were simulated. Elastic and creep properties of the digital microstructure were calculated by means of numerical homogenization based on the Finite Element Method. Autogenous shrinkage was computed by the average strain resulting from the capillary stress globally applied on the simulated microstructure.

The validation of the simulated properties with the experimental data showed that the models can help in better understanding of the shrinkage phenomenon and the factors influencing it. The effects of several input parameters on the modeled pore-sizes, mechanical, creep properties were explored. The numerical results could be used to explain some aspects of cement microstructural development, for examples, diffuse growth of hydrating cement particles in the pore space, the percolation time and the contribution of creep to shrinkage.

I cordially invite you to attend the seminar talk of Dr. Do at

location: **meeting room 1, Faculty of Aerospace Engineering**
time: **Thursday, November 6th, 2014, 16:00**

Dr. Martin Ruess, Chairman