



Multi-Phase Physicochemical Modeling of Soil-Cementitious Material Interaction

Multi-phase physicochemical modeling based on thermodynamic approach is studied on small pores of nano-micrometers as gel and capillary pores of cement paste and interlayer of bentonite and large voids of micro-millimeters among soil foundation. The basic analytical scheme consists of a hydration model associated with heat generation/water consumption, moisture transport/equilibrium, and micro-pore structure development model. In order to deal with cemented soil as well as concrete by the scheme, modeling of large airspace existing between sand particles in the cemented soil is newly added as a pore-structural component. The proposed methodology enables us to simulate material development processes of both cemented soil and concrete in a unified manner. For example, permeability of soil, cemented soil, and concrete can be automatically obtained by giving mix proportions of sand, cement and water. The proposed models are verified with experimental results of cement hydration, change of relative humidity, permeability and leaching of calcium ion from cement hydrate.

