6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

COUPLED DEM-CFD SIMULATIONS OF GRANULAR MATERIALS SUSCEPTIBLE TO SUFFUSION

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Key Words: *Discrete element modelling, coupled DEM-CFD, granular materials, erosion*

This work presents the results of coupled discrete element method – computational fluid dynamics (DEM-CFD) simulations of granular materials which may be susceptible to suffusion, a process which can occur in earth embankments in which seepage causes preferential erosion of finer particles in granular soils with a wide range of particle sizes. Suffusion is a major hazard in earth dams and this research was motivated by a desire to better understand the conditions under which it can initiate.

The coarse-grained method developed by Tsuji et al. (1993) and Xu and Yu (1997) was used to simulate the solid-fluid interaction. Materials with varying degrees of susceptibility to suffusion were simulated and particle scale parameters were recorded to allow an analysis of the link between soil microstructure and the initiation of erosion.

The results build on and show good agreement with previous non-coupled DEM analysis (Shire et al. 2014). The influence of the soil microstructure for the initiation of suffusion is highlighted, with coordination number and the stress transferred through individual particles shown to be key variables. Particle-scale erosion susceptibility is inferred from the magnitude of the particle displacements.

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