# Accepted Manuscript

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PII: S0045-7825(16)30721-6
DOI: http://dx.doi.org/10.1016/j.cma.2017.02.024
Reference: CMA 11351

To appear in: *Comput. Methods Appl. Mech. Engrg.*

Received date : 11 July 2016
Revised date : 13 February 2017
Accepted date : 16 February 2017

Please cite this article as: C. Yuan, B. Chareyre, A pore-scale method for hydromechanical coupling in deformable granular media, *Comput. Methods Appl. Mech. Engrg.* (2017), http://dx.doi.org/10.1016/j.cma.2017.02.024

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# A pore-scale method for hydromechanical coupling in deformable granular media

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**Abstract**

A pore-scale numerical method for simulating multiphase granular media is described, in which the solid skeleton is represented by a dense random packing of poly-disperse spherical particles and the pore space is discretized as a network of pores. The underlying idea is to build an efficient method for analyzing the hydro-mechanical behaviour of such materials. We design the model specifically for simulating the quasi-static primary drainage, using a criterion for the displacements of the invading fluid and expressions of the forces exerted on the solid grains by fluids pressure and surface tension. The model can reproduce some features of drainage, including fluid phase entrapment and capillary fingering. We illustrate the method by simulated primary drainage in oedometer conditions, highlighting the deformation induced by partial saturation.

*Keywords:* Drainage; pore network; surface tension; hydromechanical coupling.

## 1. Introduction

Modelling the drainage process in granular materials and the induced deformations of solid skeleton is of great importance in many areas of engineering and science, such as the slopes instability in soil mechanics [1], the oil and gas

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