The Particle Finite Element Method (PFEM) for problems in geomechanics

Antonia Larese[†*], Fernando Salazar[*], Riccardo Rossi[†*] and Eugenio Oñate[‡*]

[*] Centre Internacional de Mètodes Numèrics en Enginyeria (CIMNE)
web page: http://www.cimne.com
[†] Universitat Politècnica de Catalunya (UPC)
C. Gran Capián s/n, Campus Norte UPC, 08034 Barcelona, Spain
e-mail: antoldt@cimne.upc.edu

ABSTRACT

In the current work we present a model to simulate the behavior of granular material subjected to large deformation in a continuous framework. The objective is the simulation of failure of rockfill slopes or landslides.

The traditional Bingham regularized constitutive law proposed by Papanastasiou is taken as a starting point. The main drawback of this classical relation is that the material is characterized by a constant yield. On the contrary in the case of a granular material like rockfill, the yield stress is proportional to the effective stress and related to the internal friction angle. This is the reason why in this work we propose a variable yield Bingham model where the constant threshold is substituted by a Mohr Coulomb like failure criteria.

Since the domain is expected to undergo severe deformation, a Lagrangian technique has been chosen for the kinematical description of motion. The Particle Finite Element Method (PFEM), with its specific features, is appropriate to treat the rockfill material and its large deformations and shape changes

This model is also coupled with a level set code, developed by the authors [1, 2]. That CFD code is able to simulate the free surface and seepage evolution in presence of a porous material with a unique formulation.

The numerical results are validated by means of a comparison with experiments on scale model rockfill dams [3] and with data on landslides [4].

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