Asociación Argentina
de Mecánica Computacional

Mecánica Computacional Vol XXXI, págs. 13-13 (resumen)
Alberto Cardona, Paul H. Kohan, Ricardo D. Quinteros, Mario A. Storti (Eds.)
Salta, Argentina, 13-16 Noviembre 2012

ADVANCES IN THE PARTICLE FINITE ELEMENT METHOD (PFEM) FOR MULTIDISCIPLINARY PROBLEMS IN ENGINEERING

Eugenio Oñate[a], Sergio R. Idelsohn[a,b,c], Miguel A. Celigueta[a] and Riccardo Rossi[a]

[a]*International Center for Numerical Methods in Engineering (CIMNE), Technical University of Catalonia (UPC), Campus Norte UPC, 08034, Barcelona, Spain*

[b]*Centro Internacional de Métodos Computacionales en Ingeniería - CIMEC, INTEC, (CONICET-UNL), Santa Fe, Argentina*

[c]*Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain*

Abstract. We present recent developments in the the Particle Finite Element Method (PFEM, www.cimne.com/pfem) for analysis of complex coupled problems in engineering accounting for fluid-soil-structure interaction (FSSI) and coupled thermal effects. The PFEM uses an updated Lagrangian description to model the motion of nodes (particles) in both the fluid and the structure domains which are modelled as a single continuum. Nodes are viewed as material points which can freely move and even separate from the main analysis domain representing, for instance, the effect of water drops or excavated material. A mesh connects the nodes defining the discretized domain where the governing equations for the unified FSSI problem are solved as in the standard FEM. The necessary stabilization for dealing with the incompressibility of the fluid is introduced via the finite calculus (FIC) method. An incremental iterative scheme for the solution of the non linear transient coupled FSSI problem is used. Advances in the PFEM to allow for frictional contact conditions and surface erosion at fluid-solid and solid-solid interfaces via mesh generation are described. We present examples of application of the PFEM to a number of coupled problems such as the effect of waves and water streams on civil and naval structures, the stability of earth dams in overtopping situations, the large motions of floating and submerged bodies, the impact of slurry flows on structures , the erosion due to water streams in river beds and slopes, excavation and drilling problems in the construction and oil/gas industries, the melting and dripping of objects under the effect of fire and the simulation of industrial forming problems, among others.