Asociación Argentina
de Mecánica Computacional

Mecánica Computacional Vol XXIX, págs. 4081-4081 (resumen)
Eduardo Dvorkin, Marcela Goldschmit, Mario Storti (Eds.)
Buenos Aires, Argentina, 15-18 Noviembre 2010

SEARCHING ALGORITHMS TO SPEED-UP CFD COMPUTATIONS

Norberto M. Nigro[a], Sergio R. Idelsohn[b], Alejandro Limache[a] and Néstor A. Calvo[c]

[a]*International Center for Computational Methods in Engineering (CIMEC), INTEC-CONICET, Güemes 3450, Santa Fe, Argentina, nnigro@intec.unl.edu.ar, http://www.cimec.org.ar*

[b]*International Center for Numerical Methods in Engineering (CIMNE), Technical University of Catalonia, Barcelona, Spain, sergio@cimne.upc.edu*

[c]*Facultad de Ingeniería y Ciencias Hídricas, Universidad Nacional del Litoral, Ciudad Universitaria, Santa Fe, Argentina, nestor.calvo@gmail.com*

Abstract. In this work a new methodology based on the Particle Finite Element Method (PFEM) is presented, modified accordingly to be applied inside an strategy of very fast CFD computations. Originally, as a typical lagragian method, PFEM was designed as a meshless method but a background mesh should be adopted to compute the finite element problems appeared at each different steps of any segregated method like fractional step. Even though the equations are decoupled and the merhod seems to work like a meshless method PFEM suffers of severe restrictions in the time step selection that hindered its advantages in terms of efficiency. One of the most obvious restrictions is confronted when the algorithm need to move the particles keeping the topology fixed, like any moving mesh. During this phase the time step is severely reduced in order to avoid element inversions. Another limitation comes from the way in which the integration of the particle trajectories are done. In order to increase the time step as much as possible avoiding any instability this work presents a novel way in which the moving mesh is avoided through a very different splitting of the segregation method and also a new way to solve the particle position and velocity updating. Due to this end the splitting of the fractional step method is changed in order to use 2 different meshes, one for the fractionary velocity computation and another for the pressure and the velocity correction with a remeshing step in between. In this way the present method seems to be much more a meshless method than before with the inherent advantages in terms of efficiency. Only the pressure equation remains for solving on a given mesh, the new one. Concerning the integration of the particle motions in this work a characteristic-like method is proposed to enhance the prediction of the trajectory of the whole set of particles providing some nice features in terms of stability and a better solution for the interaction between the particle and the boundaries. Finally some examples are presented showing the capability of the new proposal in terms of accuracy and stabilty. Future work will be oriented to improve the programing of these ideas taking into account the usage of a more powerfull hardware, like GPGPU, with the focus on real time CFD applications.