11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

Efficient Parallel Algorithms for Embedded Fluid Structure Interaction with Unstructured Mesh

P. Dadvand*[1], A. Coll[1], R.Rossi[1], R. Wüchner[2], and E. Oñate[1]

[1] Centre Internacional de Mètodes Numèrics en Enginyeria (CIMNE), Gran Capità s/n, Edifici C1, Campus Nord UPC, 08034 Barcelona, Spain, rrossi@cimne.upc.edu, http://www.cimne.com
[2] Chair of Structural Analysis, Technische Universität München (TUM), Arcisstr. 21, 80333 Munich, Germany, wuechner@tum.de, http://www.st.bgu.tum.de/

Key Words: *Embedded, Coloring, Distance Function, Parallel computing.*

The industrial simulation is observing a considerable increment in the size and complexity of the problems. This trend demands more computational resource and also more robustness of the algorithms. The first issue requires an efficient use of hardware and parallelization and the latter can be address by embedded methods. In this work we present efficient parallel algorithms for searching the embedded objects, assigning the in and out color, calculating the distance function and interpolate variables.

The first part of the work is dedicated to the data structures which are used to find the intersected elements and interpolating the results. The efficiency of the embedded method depends highly to this selection especially when the structure moves and so the cut elements and distances are changing.

In the second part the coloring algorithm which is used to define the inside and outside for the embedded elements is described. This part is completed with the parallelization of the method. The algorithm is based on ray casting [1] technique which is customized for using with embedding methods and also especial cases like shells and memberanes.

Finally the calculation of the distance will be described. The proposed algorithm comes as an extension to the coloring algorithm which propagates the exact distances through the fluid while performing the ray casting process. In this way the algorithm reduces considerably its computational task.

REFERENCES

[1] S. Shirra, How reliable are practical point-in-polygon strategies? *Proceedings of the 16th annual European symposium on Algorithms.*, ESA '08, pp. 744–755, 2008.