8th. World Congress on Computational Mechanics (WCCM8)
5th. European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008)
June 30 – July 5, 2008
Venice, Italy

THE EXTENDED FINITE ELEMENT METHOD (XFEM) FOR BOUNDARY LAYERS

***Alaskar Alizada[1], Thomas-Peter Fries[2]**

[1] RWTH Aachen, CATS
Steinbachstr. 53 B
52074 Aachen, Germany
alizada@cats.rwth-aachen.de

[2] RWTH Aachen, CATS
Steinbachstr. 53 B
52074 Aachen, Germany
fries@cats.rwth-aachen.de

Project homepage:
www.xfem.rwth-aachen.de

Key Words: *XFEM, Corrected XFEM, boundary layers, discontinuities.*

ABSTRACT

The extended finite element method (XFEM) [1] is frequently used for the approximation of solutions with discontinuities or other locally non-polynomial phenomena. It enables the inclusion of known solution properties into the approximation space. Thereby, optimal convergence rates are achieved for solutions that involve discontinuities and singularities within elements. The simulation is typically carried out on simple (often regular) meshes which do not need to take the position of the special solution characteristics into account.

In fluid simulations, meshes are often refined near no-slip boundaries in order to resolve boundary layers. We propose a concept which uses special enrichment functions for boundary layers near the wall. No mesh refinement is required. These enrichment functions are incorporated in the frame of the corrected XFEM [2]. In each element near the wall, an individual enrichment function is used. The number of additional unknowns in the XFEM approximation is still significantly smaller than in a classical FEM approximation on a refined mesh with comparable accuracy.

REFERENCES

[1] T. Belytschko, N. Moës, S. Usui, C. Parimi: Arbitrary discontinuities in finite elements, Internat. J. Numer. Methods Engrg., **50**, 993-1013, 2001.

[2] T.P. Fries: A corrected XFEM approximation without problems in blending elements, Internat. J. Numer. Methods Engrg., DOI 10.1002/nme.2259, 2007.