COMPLAS 2017
XIV INTERNATIONAL CONFERENCE ON COMPUTATIONAL PLASTICITY
5-7 September 2017, Barcelona, Spain

Elemental Enrichment Strategies for Fluid Mechanics Problems using the PFEM2

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KEYWORDS: Enriched FE Spaces; Discontinuous Fields; PFEM2.

ABSTRACT

Conducting a numerical simulation of a domain where there exist strong or weak discontinuities in the unknown field is still a challenge in computational mechanics. There are many cases in real world where the solution procedure using numerical methods require a way of dealing with this sort of situation, such as: simulation of multiple materials with changing physical properties. Moreover, simulation of two materials where one material being very viscous and the other one having small viscosity could be considered as plasticity. There are various solution methodologies for these sorts of cases, where all have their advantages and disadvantages.

The work that will be presented here is a solution procedure for the cases mentioned above by enriching the FE space and statically condensing the occurring additional degrees of freedom in the elemental level. A more detailed information could be obtained in [1]. Implementing this procedure, a Stokes Flow solver that uses the ASGS [2] stabilization technique has been generated. Furthermore, for the solution of Navier-Stokes Equations with this enrichment strategy, second generation Particle Finite Element Method (PFEM2) strategy has been employed. PFEM2 is a solution strategy for the Navier-Stokes Equations which offers various advantages [3, 4].

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