

ON THE ENRICHMENT OF THE SEMI-LAGRANGIAN PARTICLE FINITE ELEMENT METHOD

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ABSTRACT

The Semi-Lagrangian Particle Finite Element Method (SL-PFEM) is a numerical method mainly used for solving fluid dynamics problems that is still under development. The advantage of this method is its excellent numerical properties such as the minimum numerical erosion in the convective transport or its great stability. As the convective transport has little numerical erosion then another advantage is the ability to transport variables using the particles, such as an interface for example. [1, 2]

Therefore, for this work, we present how an interface problem (e.g. Free Surface or Solid – Fluid interaction) can be analyzed using the SL-PFEM method by means of element enrichment. In these interface problems, we find that jumps or discontinuities appear in the case of a Free Surface or simply a wall must be inserted in the case of a solid. So, in order to catch these discontinuities or apply the wall condition, new degrees of freedom must be inserted where the intersections occur. These new degrees of freedom must be added to the system, and a good approach is to generate an enriched mesh that allows us to collapse the new degrees of freedom without having to change the size of the system of equations. [3, 4]

After showing how an enriched space allows us to efficiently obtain the fluid behavior when it has an interface problem, we will present different validations of different test cases that show the capabilities of this method.

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