

## Numerical approximation of convection-diffusion problems through the PSI method

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### ABSTRACT

The Fluctuation Splitting (FS) methods were introduced by Roe and developed lately by Deconinck and other authors (see [2]). These methods were constructed for the approximation of transport equations and have been extensively used in computational fluid mechanics. A special feature relies in the possibility of adapting the usual upwind techniques of the finite volume methods to the finite element framework.

One of the most advantaged FS scheme is the non-linear PSI method because of its positiveness and second order accuracy. This method provide us of an accurate solution in large gradient zones, so as when the solution is affected by a discontinuity.

In this conference we shall describe the writing of the FS methods under a Petrov-Galerkin formulation, we shall also establish the main results about the theoretical analysis of the convection-diffusion problem solved by the PSI method (cf. [1]). Finally, some numerical test will be shown for checking the good behavior of the PSI method for particular systems where boundary and interior layers appear.

### References

- [1] T. CHACÓN, M. GÓMEZ AND G. NARBONA, Numerical analysis of the PSI solution of advection-diffusion problems through a Petrov-Galerkin formulation. *Math. Models Methods Appl. Sci.* **17** (11), 1905–1936, (2007).
- [2] H. DECONINCK, H. PAILLÈRE, R. STRUIJS AND P.L. ROE, Multidimensional upwind schemes based on fluctuation-splitting for systems of conservation laws. *Computational Mechanics* **11**, 323–340, (1993).

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