AN OPTIMALLY STABILIZED MESHLESS METHOD FOR COMPRESSIBLE FLOWS ACCELERATED WITH MACHINE LEARNING

# Ricardo. Puente¹

1 Imperial College London, Exhibition Rd, South Kensington, London SW7 2BX, United Kingdom, r.puente@imperial.ac.uk

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A meshless method for compressible flow based on finite difference coefficients generated with Radial Basis Function interpolators is presented. Non-linear stability is guaranteed by a Flux Corrected Transport algorithm [1]. This algorithm requires of the application of artificial viscosity terms that fulfil a Local Extremum Diminishing (LED) condition [2].

A novel procedure for computing these terms is proposed, involving the specification of an optimization problem which minimizes the magnitude of artificial viscosity, and enforces both the LED condition and conservation. This procedure can be applied to arbitrary stencils in terms of both number of nodes and node distribution. As solving this optimization problem in a node-by-node basis becomes prohibitively costly, a Machine Learning model trained with an extensive database of solutions is used to accelerate the calculation of the artificial viscosity hyperparameters.

The result is an arbitrary order shock capturing method, with improved order of convergence in unevenly spaced stencils with respect to conventional fixed coefficient methods. Potential applications are fluid-structure interaction problems where large deformations and contact events pose a challenge to mesh adaptation algorithms.

**REFERENCES**

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