6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

Towards Algebraic Flux Correction Methods for Continuum Multifluid Electromagnetic Plasma Models

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Key Words: *Continuous Galerkin FE, Algebraic Flux Correction, variational limiters, ion/electron plasmas.*

The mathematical basis for the continuum modeling of multifluid plasma physics systems is the solution of the governing partial differential equations (PDEs) describing conservation of mass, momentum, and total energy for each fluid species, along with Maxwell's equations for the electromagnetic fields. The resulting systems are characterized by strong nonlinear and nonsymmetric coupling of fluid and electromagnetic phenomena, as well as the significant range of time- and length-scales that these interactions produce. This talk presents recent progress in developing implicit and implicit/explicit algebraic flux correction (AFC) methods for these complex coupled multiple-time-scale systems. The AFC methods are based on nodal and element-based variational limiting strategies that enforce local bounds and positivity preservation constraints. To evaluate the methods we consider both smooth analytic solutions of the multifluid system and challenging multifluid electromagnetic shock problems in both the non-collisional and collisional regimes.

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