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NUMERICAL APPROXIMATION OF MHD FLOWS

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ABSTRACT

The continuum magnetohydodynamics (MHD) model describes the interaction of an electrically charged fluid with electric and magnetic fields. The resulting PDEs are strongly coupled, highly nonlinear, and characterized by physical mechanisms that span a wide-range of interacting time scales. Solutions of this system can include very fast component time-scales to slowly varying dynamical time-scales that are long relative to the normal-modes of the model equations. The strong nonlinear coupling and multi-scale character of these models makes the development of stable and robust discretizations and solution methods difficult. As a result there exists a large number of distinct and applicable approaches with various advantages and disadvantages. For example, numerous finite volume and finite element discretizations of the MHD equations exist. A partial list includes: discretizations that satisfy the constraints and involutions by construction (e.g. physics compatible), projection methods, stabilized finite elements, and least-squares finite element methods. For solution methods, there are operator split, semi-implicit, implicit-explicit (IMEX) and fully-implicit techniques. The goal of this mini-symposium is to bring together researchers in these fields and explore the applicability and performance of the methods on varying applications. Topics of interest including, but not limited to, block and physics-based preconditioners, operator-split methodologies, adaptive refinement, and discretization approaches all applied to challenging MHD applications are encouraged.

REFERENCES

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