SIAM/APPLIED AND NUMERICAL ANALYSIS SEMINAR

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Title: A diffuse interface model and semi-implicit energy stable finite element method for two-phase MHD flows

Abstract: In this talk, we present a diffuse interface model and finite element approximation for two-phase magnetohydrodynamic (MHD) flows with different viscosities and electric conductivities. An energy stable scheme, which is based on the finite element method for the spatial discretization and first order semi-implicit scheme combined with convex splitting method for the temporal discretization, is proposed to solve this new model. The numerical scheme is proved to be mass-conservative and energy law preserving. By Leray-Schauder fixed point theorem, the existence of solutions to the numerical scheme is shown. The uniqueness of the numerical solutions is obtained. Utilizing the stability of the numerical scheme and the compactness method, the existence of the weak solutions to the two-phase MHD model is established as well. Furthermore, given more regularity on the weak solution, the convergence of the numerical scheme is derived. Finally, numerical experiments are provided to verify the theoretical results and validate the proposed model.