Uniform stabilization of the MHD equations by means of interior localized, minimally finite dimensional feedback controls in Besov setting

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We consider the Magnetohydrodynamic equations in dimension $d = 2$ and $d = 3$, which couple the Navier-Stokes equations for the velocity fluid with the Ohm-Maxwell equations for the magnetic field. The uncontrolled system generates a s.c. analytic semigroup in Sobolev as well as Besov settings. We start with an unstable equilibrium solution. We then seek explicit, finite dimensional interior localized feedback controllers, of minimal dimension, such that the corresponding feedback MHD problem is well-posed and uniformly stable near the chosen unstable equilibrium solution in a suitable Besov space ("close" to L^3 for $d = 3$). A critical starting obstacle consists in showing a Unique Continuation Property for a suitable over-determined eigenproblem. This property then guarantees the Kalman algebraic condition of controllability of the projected unstable finite dimensional component of the feedback problem. This is done by a technical proof which uses Carleman-type estimates. This study continues the work of the authors on feedback stabilization of Navier-Stokes equations, Boussinesq systems, and now MHD equations, by either localized interior or localized boundary feedback controllers in Besov setting.

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