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Symmetric Ideal Magnetofluidostatic Equilibira with Non-Vanishing Pressure Gradients in Asymmetric Confinement Vessels[1]
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We study the possibility of constructing steady magnetic fields satisfying the force balance equation of ideal magnetohydrodynamics with tangential boundary conditions in asymmetric confinement vessels, i.e. bounded regions that are not invariant under continuous Euclidean isometries (translations, rotations, or their combination). This problem is often encountered in the design of next-generation fusion reactors. We show that such configurations are possible if one relaxes the standard assumption that the vessel boundary corresponds to a pressure isosurface. We exhibit a smooth solution that possesses an Euclidean symmetry and yet solves the boundary value problem in an asymmetric ellipsoidal domain while sustaining a non-vanishing pressure gradient. This result provides a definitive answer to the problem of existence of regular ideal magnetofluidostatic equilibria in asymmetric bounded domains. The question remains open whether regular asymmetric solutions of the boundary value problem exist.

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