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The Magnetohydrodynamic Couette Flow in a Plane and Spherical Geometries with Singular Hartmann Boundary Layers

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A magnetohydrodynamic Couette Flow, meaning a flow between two boundaries one of which moves at a constant speed is considered in two geometries: Carthesian and Spherical. The solution is provided for a case of low Reynolds numer and Large Hartmann number. In both geometries the external magnetic field is chosen in such a way, that singular Hartmann boundary layers appear, where the component of the magnetic field which is perpendicular to the boundary vanishes. In this singular region the velocity of the fluid exeedes the velocity of the moving boundary due to strong currents leaving the singular Hartmann layer. This phenomenon of super-velocities was studied by E. Dormy, D. Jault and A.M. Soward (2001) where they resolved a case of spherical Couette Flow with insulating outer boundary. Following their ideas I found solutions for spherical and a plane Couette Flow with conductive boundaries. The influence of the conductivity of the boundaries on the super-velocities is discussed here.

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