FM6S_10921

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Poloidal-Toroidal Decomposition in Cylindrical von Karman Flow

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The goal of the VKS experiment is to observe a laboratory-scale dynamo effect in the cylindrical von Karman flow. Because there exists at present no complete numerical treatment of this configuration, we have developed an efficient three-dimensional pseudospectral code capable of solving the Navier–Stokes equations in a finite cylindrical geometry, to be coupled with the Maxwell equations. A poloidal-toroidal decomposition insures that fields are divergence-free by construction which is very important for applications to the magnetohydrodynamic case. The cylindrical domain is treated by using in the radial direction a polynomial basis which is regular at the domain axis. The satisfaction of high-order and/or coupled boundary conditions is guaranteed by the influence matrix method.

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