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Poloidal-toroidal decomposition applied to the MHD equations in a finite cylindrical geometry PIOTR BORONSKI, LAURETTE TUCKERMAN, LIMSI-CNRS, France — Motivated by the recent international research effort to create an experimentally self-sustained dynamo, we have developed a numerical code for solving the three-dimensional MHD equations for a conducting fluid in a finite cylindrical geometry. The flow configuration corresponds to the VKS (von Karman sodium) dynamo experiment carried out by experimentalists at CEA-Saclay, ENS-Paris, and ENS-Lyon. The configuration corresponds to the cylindrical container filled with a conducting fluid whose motion is driven by the counter-rotating disks. Our pseudospectral code uses a toroidal-poloidal decomposition to ensure the divergence-free velocity and magnetic fields. We propose a novel approach, based on the influence matrix technique, for imposing the condition of the continuity of the magnetic field at the boundary between the conducting fluid and a vacuum. Using this code we investigate a recently discovered phenomenon observed experimentally (Ravelet et al., *Phys. Rev. Lett.*, 2004): transition between states of a highly turbulent flow. This transition seems to correspond to the bifurcation of the time-averaged mean flow.

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