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Global MHD simulations of the magneto-rotational instability in complex magnetic topologies[1] BERTRAND LEFEBVRE, AMITAVA BHATTACHARJEE, FATIMA EBRAHIMI, KAI GERMASCHEWSKI, University of New Hampshire — The velocity shear-driven magnetorotational instability (MRI) is believed to contribute to turbulence and momentum transport in astrophysical accretion disks. We conduct global three-dimensional MHD simulations of the MRI in a cylindrical geometry. Our focus is on the effects of complex magnetic topologies with both poloidal and toroidal magnetic fields. Previous theoretical ideal MHD studies of laboratory plasmas in the presence of sheared flows have shown that the continuum MHD modes are destabilized by the flows, and overstability is generic. We find that a toroidal magnetic field component transforms the MRI from a purely growing low-frequency mode to an overstable one, and that the fastest growing modes are non-axisymmetric. This modifies the nonlinear evolution compared to cases with simpler topologies. We compare simulations from the NIMROD and MRC codes, present linear and nonlinear results and their implications for astrophysical plasmas as well as the MPCX.

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