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Approach to Magnetic Self-excitation in the Madison Dynamo Experiment E.J. SPENCE, R.A. BAYLISS, C.B. FOREST, C.M. JACOBSON, R.D. KENDRICK, M.D. NORNBERG, University of Wisconsin-Madison, MADISON DYNAMO EXPERIMENT TEAM — The Madison Dynamo Experiment is a 1 m diameter spherical vessel filled with flowing liquid sodium, used to study magnetic field generation and magnetohydrodynamic (MHD) turbulence. The approach to magnetic self-excitation is studied by applying magnetic fields of different polarizations and frequencies to the flowing fluid; internal and external probes measure the induced magnetic field. The induced field is used to determine the profiles of the fluid's mean velocity field through an inversion process. The resulting electromagnetic model of the system provides both the magnetic Reynolds number, R_m, and the magnetic growth rate. Variation in the geometry and speed of the fluid as a function of R_m (for $0 < R_m < 110$) is presented, as well as an estimate of the critical R_m required for self-excitation as computed from an eigenmode analysis.

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