Oblate Spheroidal Mean Field Kinematic Dynamos

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The self-exciting kinematic dynamo instability is considered in a uniformly electrically-conducting fluid which occupies an oblate spheroid. The conducting fluid is surrounded by an insulating exterior. Regeneration of the magnetic field is due to a turbulent mean-field alpha-effect. The problem has application to galactic dynamos. The linear instability of the magnetic field is investigated numerically. Homeoidal spheroidal toroidal-poloidal solenoidal representations are used for the magnetic field and the velocity. The magnetic induction equation is transformed so that it differs from the spherical case by an anisotropic magnetic diffusion and an anisotropic alpha-effect, even if the original alpha-effect is isotropic. The equations are discretised using spherical harmonic expansions of the magnetic toroidal-poloidal potentials and finite differences in scaled radius. The linearised instability problem then reduces to a generalised eigen- and critical-value problem. Results are presented for several models, including non-axisymmetric solutions.