Instabilities in magnetic spherical Couette flow

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I consider the flow of an electrically conducting fluid in a spherical shell, with the inner sphere rotating, and the outer sphere at rest. A uniform magnetic field is also imposed, parallel to the inner sphere's axis of rotation. I numerically compute both the axisymmetric basic state, and show how it varies with the Reynolds number Re (measuring the inner sphere's rotation rate) and the Hartmann number Ha (measuring the magnetic field strength), and then also compute the onset of non-axisymmetric instabilities. For weak fields the instabilities are equatorially antisymmetric; for strong fields they are equatorially symmetric. The transition from one regime to the other is mapped out in detail. Finally, I consider the nonlinear equilibration of some of these instabilities, and obtain further bifurcations and transitions between different states.