Dynamo action in precessing cylinders

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We use a nonlinear magnetohydrodynamics (MHD) code called SFEMaNS (for Spectral / Finite Elements for Maxwell and Navier-Stokes equations,
Guermond at al., JCP, 2011) to study the dynamo action in a precessing cylinder.
This code integrates the nonlinear MHD equations in heterogeneous domains
(with spatial distributions of electrical conductivity or magnetic permeability).
The conducting domain is assumed to be axisymmetric and embedded in vacuum.
The approximation technique is based on a Fourier expansion
in the azimuthal direction and uses finite elements in meridional sections.
Five parameters govern the flow: the aspect ratio of the container, the precession
angle and precession rate (forcing parameters), and the Ekman and magnetic Prandtl numbers (fluid parameters,
E and Pm). The container's height is chosen to be equal to its diameter and the precession axis is set to be orthogonal
to the rotation axis. We have performed parametric studies in the hydrodynamical regime or in
the MHD regime to investigate which configuration is the most favorable for dynamo action, in view of
application to experimental fluid dynamo studies.

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