Convective periodic axisymmetric flows in rotating fluid spheres: from their onset to their stability.

Juan Sánchez Umbría
Universitat Politècnica de Catalunya, Spain
juan.j.sanchez@upc.edu

The onset of convection in rotating fluid spheres and shells usually gives rise to rotating waves, which can travel in the prograde or retrograde direction relative to the frame of reference rotating with the bulk of the fluid. It was discovered recently that axisymmetric periodic regimes can also be preferred at low Prandtl, Pr, and Ekman, Ek, numbers. These flows are known as torsional.

In order to determine the region in the parameter space where the torsional flows are the first bifurcated solutions, the curves of double Hopf points corresponding to simultaneous transitions to azimuthal wave numbers (m_1, m_2)=(0,1), (1,1), (0,2), etc. were computed. These curves form the skeleton of the bifurcation diagram, separating the regions of different preferred azimuthal wave numbers. Their intersections are triple Hopf points, several of which were found. It turned out that the region of interest was limited by the curves (m_1, m_2)=(0,1) and (0,2).

The periodic torsional solutions emerging form the conduction state were computed for several pairs (Pr,Ek) inside the above mentioned region, using Newton-Krylov continuation methods, and their stability to azimuthal dependence was studied via their Floquet multipliers.

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