Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Pinning of rotating waves in systems with imperfect $SO(2)$ symmetry FRANCISCO MARQUES, ALVARO MESEGUER, Universitat Politecnica de Catalunya, JUAN M. LOPEZ, RAFAEL PACHECO, Arizona State University — Experiments in small aspect-ratio Taylor-Couette flows have reported the presence of a band in parameter space where rotating waves become steady non-axisymmetric solutions (a pinning effect) via infinite-period bifurcations that previous numerical simulations were unable to reproduce. Here we present numerical simulations that include a small tilt of one of the endwalls, simulating the effects of imperfections that break the $SO(2)$ axisymmetry of the problem, and indeed are able to reproduce the experimentally observed pinning of the rotating waves. A detiled analysis of the corresponding normal form shows that the problem is more complex than expected, and the complete unfolding is of codimension six. A detailed analysis of different types of imperfections indicates that a pinning region surrounded by infinite-period bifurcation curves appears in all cases. Complex bifurcational processes, strongly dependent on the specifics of how the symmetry is broken, appear very close to the intersection of the Hopf bifurcation and the pinning region. The numerical and theoretical results agree with the previous experimental studies.

Francisco Marques
Universitat Politecnica de Catalunya

Date submitted: 07 Aug 2010 Electronic form version 1.4