Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Controlling Transition in Taylor-Couette Flow with Spatial Forcing YASSER ABOELKASSEM, ANNE STAPLES, Virginia Polytechnic Institute and State University — The linear stability of the flow in the (narrow) annular gap between two infinitely long cylinders, driven by an axisymmetric sinusoidal perturbation to the radius of the inner cylinder in the axial direction is analyzed. A closed-form solution for the basic flow in the system is derived. Experiments and computational investigations of this system have given differing results. In the seminal experiment performed by Ikeda and Maxworthy (Phys. Rev. E, 1994), the perturbation was found to have no effect on the first stability boundary. In subsequent theoretical investigations, authors have concluded that circular flow cannot exist in the modified system, and that the basic flow is Taylor Vortex Flow. In this study, we find that while the perturbation seems to always be destabilizing, circular flow does indeed exist in the system, in agreement with experimental observations. For small to moderate forcing amplitudes, the critical Taylor number for the first transition is only reduced slightly, by an amount that depends on the forcing amplitude and wavelength. The reduction in the first critical Taylor number is speculated to lie within the margin of error in the experiments performed by Ikeda and Maxworthy.

Abstract APS

Date submitted: 02 Oct 2009 Electronic form version 1.4