Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

The Effect of Eccentricity on the Stability of Spiral Flows PIETRO VALSECCHI, ExxonMobil Upstream Research Company — The instability mechanisms acting on the flow of fluid between two concentric cylinders where an axial pressure gradient is also present have been extensively studied and understood over the past three decades [1,2]. The eccentricity of one cylinder axis with respect to the other disrupts the axial symmetry that allows for the simplified analytical description of the base flow and introduces a radial component of the base flow. In the present study, a small eccentricity is introduced and the variation of the flow over the tangential direction is described by the first Fourier mode in $/theta$. With the origin at the center of the inner cylinder, the modifications to the governing equations are discussed, as well as the deviation in the boundary conditions given by the changing distance of the wall from the center. An analytical formulation of the base flow is derived and the bases for a linear stability calculation are laid.

[1] Hasoon, M.A. and Martin, B.W., The stability of viscous axial flow in an annulus with a rotating inner cylinder, Proc. R. Soc. London, A, 325, 1977
[2] DiPrima, R.C. and Pridor, A., The stability of viscous flow between rotating concentric cylinders with an axial flow, Proc. R. Soc. London, A, 266, 1979

Pietro Valsecchi
ExxonMobil Upstream Research Company

Date submitted: 06 Aug 2010 Electronic form version 1.4