Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Computational simulations of rotating-disk induced flows in circular cylinders DANIEL T. VALENTINE, MICHAEL J. BRAZELL, BRIAN HELENBROOK, Clarkson University — Numerical solutions of the axisymmetric Navier-Stokes equations are presented that illustrate the flow regime where vortex breakdown occurs. The parameters of the problem are the aspect ratio of the cylindrical container, $A = H/R$, where H is the height of the cylinder and R is the radius of the cylinder, the radius ratio of the radius of the disk, R_d/R, where R_d is the radius of the disk, and the dimensionless rotation speed, viz., the Reynolds number, $Re = R^2\Omega/\nu$, where Ω is the angular velocity of the disk and ν is the kinematic viscosity of the Newtonian fluid within the container. Comparisons with the now classical lid-driven flows are made. Flow visualizations of vortex breakdown in a rotating disk driven flow observed in a relatively crude experimental apparatus is presented to illustrate the robustness of this phenomenon. Comparisons with numerical predictions illustrate that this phenomenon is predominantly an axisymmetric phenomeon. The flow visualizations illustrate interesting three- dimensional features that need further investigation.

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Date submitted: 08 Aug 2011 Electronic form version 1.4