Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Effect of Axial Pressure Gradient on the Bifurcation Structure of Viscous Vortex Breakdown ELENA VYAZMINA, JOSEPH NICHOLS, JEAN-MARC CHOMAZ, PETER SCHMID, LadHyX Ecole Polytechnique — Incompressible open swirling flows are studied by means of direct numerical simulation (DNS) and linear stability analysis. The bifurcation structure is obtained by varying control parameters including: the swirl parameter S, the Reynolds number Re, and the nondimensional external pressure gradientβ. Nonlinear steady states are traced by pseudo-arclength continuation using the Recursive Projection Method (RPM) applied to the fully nonlinear DNS. For zero pressure gradient and large Re, the bifurcation curve shows a characteristic fold representing the existence of multiple solutions associated with vortex breakdown. Large favorable pressure gradients prevent vortex breakdown giving access to new stable or unstable branches corresponding to high swirl number, breakdown-free states. These branches are traced back to the case with zero pressure gradient by applying continuation into the pressure gradient parameter.

Jean-Marc Chomaz
LadHyX Ecole Polytechnique

Date submitted: 03 Aug 2007 Electronic form version 1.4