Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Cylinder wakes in quasi-two-dimensional flows with surface friction I: instability and scaling[1] JEMIN SHIM, JAMIE H. W. LI, DAVID F. RASCHKO, PAUL W. FONTANA, Seattle University — We measured the frequency of vortex shedding produced by cylinders in a quasi-two-dimensional system with homogenous drag. The system is characterized by the Reynolds number $Re = U_0D/\nu$ (U_0 = flow speed without the obstacle, D = cylinder diameter, ν = kinematic viscosity), and a dimensionless drag parameter, $\alpha^* = D^2/(L_s^2 Re)$ (L_s = length scale above which drag force exceeds viscous force). We investigated the scaling of the Strouhal number $St = fD/U_o$ (f = vortex shedding frequency) and compared it with conventional measurements in flows without homogenous drag. The dynamics bifurcates above a critical diameter $D_c \sim L_s$, indicating that the effect of surface friction becomes important. Increased fluctuations beyond the bifurcation indicate the onset of a previously unobserved instability associated with the drag. Also, near some critical parameters, shear instability without vortex shedding is observed, with vortex streets appearing at both higher and lower Reynolds number; the mode at lower Reynolds number has not previously been observed.

[1]Supported by the National Science Foundation under Grant No. CBET-0854509, the M. J. Murdock Charitable Trust, and the Clare Boothe Luce Foundation.

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Date submitted: 02 Aug 2013 Electronic form version 1.4