Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

On the Oseen flows in 2D[1] JONATHAN GUSTAFSSON, BARTOSZ PROTAS, McMaster University — This investigation concerns numerical evaluation of solutions of the Oseen equation in two–dimensional exterior domains. The significance of the Oseen approximation consists in that it captures the correct asymptotic behavior at infinity of the "physically reasonable" solutions of the steady–state Navier–Stokes system. Thus, such Navier–Stokes solutions can be computed as perturbations about the Oseen solution. A formal closed–form (series) solution of the Oseen problem was derived by Tomotika & Aoi (1949), and features an infinite number of coefficients which have to be determined by matching against the boundary conditions. While in the past this solution was used to compute very coarse approximations only of the the Oseen flow, the present investigation seeks to determine such approximations with an arbitrary accuracy. We show that such a task is in fact nontrivial, as it leads to algebraic problems with extremely poor conditioning. We will discuss different methods of getting around these difficulties, and will present Oseen solutions for a range of Reynolds numbers. In addition, we will also address the structure of the Oseen wake in the infinite Reynolds number limit.

[1]Made possible by a SHARCNET Graduate Fellowship grant.

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Date submitted: 01 Aug 2008 Electronic form version 1.4