Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Volume penalization to model falling leaves[1] DMITRY KOLOMENSKIY, MSNM-CNRS & CMI Université de Provence, Marseille, France, KAI SCHNEIDER, MSNM-CNRS & CMI Universit de Provence, Marseille, France — Numerical modeling of solid bodies moving through viscous incompressible fluid is considered. The 2D Navier-Stokes equations, written in the vorticity-streamfunction formulation, are discretized using a Fourier pseudo-spectral scheme with adaptive time-stepping. Solid obstacles of arbitrary shape are taken into account using the volume penalization method. Time- dependent penalization is implemented, making the method capable of solving problems where the obstacle follows an arbitrary motion. Numerical simulations of falling leaves are performed, using the above model supplemented by the discretized ODEs describing the motion of a solid body subjected to external forces and moments. Various regimes of the free fall are explored, depending on the physical parameters and initial conditions. The influence of the Reynolds number on the transition between fluttering and tumbling is investigated, showing the stabilizing effect of viscosity.

[1]We thankfully acknowledge financial support from the ANR, project M2TFP.

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Date submitted: 24 Jul 2007 Electronic form version 1.4