Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Numerical Simulation of the "Fluid Mechanical Sewing Machine"
PIERRE-THOMAS BRUN, Institut Jean le Rond dAlembert/Lab. FAST, UPMC, Univ Paris-Sud, CNRS, BASILE AUDOLY, Institut Jean le Rond dAlembert, UPMC, CNRS, NEIL RIBE, Lab FAST, UPMC, Univ Paris-Sud, CNRS — A thin thread of viscous fluid falling onto a moving conveyor belt generates a wealth of complex "stitch" patterns depending on the belt speed and the fall height. To understand the rich nonlinear dynamics of this system, we have developed a new numerical code for simulating unsteady viscous threads, based on a discrete description of the geometry and a variational formulation for the viscous stresses. The code successfully reproduces all major features of the experimental state diagram of Morris et al. (Phys. Rev. E 2008). Fourier analysis of the motion of the thread's contact point with the belt suggests a new classification of the observed patterns, and reveals that the system behaves as a nonlinear oscillator coupling the pendulum modes of the thread.

Pierre-Thomas Brun
Institut Jean le Rond dAlembert/Lab.
FAST, UPMC, Univ Paris-Sud, CNRS

Date submitted: 27 Jul 2011 Electronic form version 1.4