A Particle/Panel Method for Vortex Sheet Roll-Up ROBERT KRASNY, University of Michigan — Vortex sheets are commonly used in fluid dynamics to model thin shear layers in slightly viscous flow. Some of the first Lagrangian particle simulations in fluid dynamics used the point vortex approximation to study vortex sheet roll-up. We will review the early fundamental contributions on this topic by Rosenhead, Birkhoff, and Moore, and then discuss more recent developments. In particular, a method is described for computing vortex sheet roll-up in 3D flow in which the sheet surface is represented by a set of quadrilateral panels with Lagrangian particles at the vertices. The particles are advected by a regularized Biot-Savart integral and the induced velocity is evaluated by a particle-cluster treecode. The panels are adaptively subdivided to maintain resolution as the sheet deforms. The method is applied to simulate the collision of two vortex rings. The results shed light on the dynamics of vortex filaments in fully 3D flow.

Robert Krasny
University of Michigan

Date submitted: 26 Nov 2005   Electronic form version 1.4