1048-65-154 **Anita T Layton*** (alayton@math.duke.edu), Department of Mathematics, Duke University, Box 90320, Durham, NC 27705. *A Velocity Decomposition Approach for Moving Interfaces in Viscous Fluids.*

We present a second-order accurate method for computing the coupled motion of a viscous fluid and an elastic material interface with zero thickness. The fluid flow is described by the Navier-Stokes equations, with a singular force due to the stretching of the moving interface. We decompose the velocity into a "Stokes" part and a "regular" part. The first part is determined by the Stokes equations and the singular interfacial force. The Stokes solution is obtained using the immersed interface method, which gives second-order accurate values by incorporating known jumps for the solution and its derivatives into a finite difference method. The regular part of the velocity is given by the Navier-Stokes equations with a body force resulting from the Stokes part. The regular velocity is obtained using a time-stepping method that combines the semi-Lagrangian method with the backward difference formula. Because the body force is continuous, jump conditions are not necessary. For problems with stiff boundary forces, the decomposition approach can be combined with fractional time-stepping, using a smaller time step to advance the interface quickly by Stokes flow, with the velocity computed using boundary integrals. (Received February 05, 2009)