1060-65-118 **Anita T Layton*** (alayton@math.duke.edu), Department of Mathematics, Duke University, Durham, NC 27708. *Solving the immersed interface problem using the decomposition with boundary integral approach.*

We present a second-order accurate method for computing the coupled motion of a viscous fluid, described by the Navier-Stokes equations with Dirichlet boundary conditions, and with a singular force arising from the deformation of the moving interface. We decompose the velocity into three parts: "Stokes", "regular", and "boundary correction." The "Stokes" part is determined by the Stokes equations and the singular interfacial force. The Stokes solution is computed from the solution of three Poisson problems, with the right side replaced by a discrete Laplacian, formed by pressure or velocity values given by boundary integrals, on irregular grid points. The "regular" velocity is given by the Navier-Stokes equations with a body force resulting from the Stokes part, and with periodic boundary conditions. The boundary correction solution is described by the unforced Navier-Stokes equations, with Dirichet boundary conditions given by the deviation of the overall Navier-Stokes solution, and the boundary values of the Stokes and regular velocities. Because the regular and boundary correction solution are sufficiently smooth, jump conditions are not necessary. (Received March 25, 2010)