Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

A hybrid formulation to suppress the numerical oscillations caused by immersed moving boundaries HAOXIANG LUO, HU DAI, PAULO FERREIRA DE SOUSA, Vanderbilt University — A family of immersed-boundary methods, based on the sharp-interface representation of the boundary and local interpolation/extrapolation, has been recently developed to handle complex and moving boundary problems encountered in biological flows. Implemented typically on structured meshes, these methods save the computational cost of grid generation and take advantage of efficient computations on structured grids. However, since some of the nodes near the immersed boundary do not have the regular finite-difference stencil available for discretizing the Navier-Stokes equation, a local interpolation or extrapolation scheme is often used to reconstruct the flow field around the nodes. The drawback of this approach is that when a non-stationary boundary moves across the mesh points, the change of the stencil for the solution reconstruction causes artificial oscillations in the pressure. To suppress the oscillations, we have introduced a set of hybrid nodes on which both the Navier-Stokes solution and flow reconstruction are sought, and they are weighted according to the distance to the immersed boundary. The method has been implemented in both two- and three-dimensional solvers to handle a class of biological locomotion problems including flow-structure interaction. The accuracy and capability of the solvers will be demonstrated.

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Date submitted: 11 Aug 2009 Electronic form version 1.4