1093-65-279 **Benjamin Seibold*** (seibold@temple.edu), Philadelphia, PA, **Prince Chidyagwai**, Baltimore, MD, **Rodolfo Ruben Rosales**, Cambridge, MA, **David Shirokoff**, Montreal, Canada, and **Dong Zhou**, Philadelphia, PA. *Meshfree Finite Differences for a Pressure Poisson Equation Reformulation of the Navier-Stokes Equations with Electric Boundary Conditions.*

We present a specific Pressure Poisson Equation (PPE) reformulation of the Navier-Stokes equations for whose approximation meshfree finite difference present themselves advantageous over alternative approaches. In contrast to projection methods, PPE reformulations solve a Poisson equation for the pressure before, rather than after, the update step for the velocity field, and thus are devoid of numerical boundary layers and allow for high-order time stepping. The specific form studied here satisfies "electric" boundary conditions. Its convergent numerical approximation via unstructured mesh finite element approaches fails without the choice of sophisticated elements; and in immersed boundary approaches, the electric boundary condition must be imposed in a non-intuitive least-squares sense. In contrast, a straightforward meshfree finite difference discretization of the PDE and its boundary conditions turns out to lead to a successful numerical scheme. (Received August 18, 2013)