Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Extending the fluid projection method to simulate quasi-static elastoplastic solids CHRIS RYCROFT, Harvard University — A well-established numerical approach to solve the Navier–Stokes equations for incompressible fluids is Chorin's projection method, whereby the fluid velocity is explicitly updated, and then an elliptic problem for the pressure is solved, which is used to project the velocity field to maintain the incompressibility constraint. In this talk, a mathematical correspondence between Newtonian fluids in the incompressible limit and elastoplastic solids in the slow, quasi-static limit will be presented. This correspondence will be used to develop a new fixed-grid, Eulerian numerical method for simulating quasi-static elastoplastic solids, whereby the stress is explicitly updated, and then an elliptic problem for the velocity is solved, which is used to project the stress to maintain the quasi-staticity constraint. A number of correspondences between incompressible fluid mechanics and quasi-static elastoplasticity will be shown, creating possibilities for translating other numerical methods between the two classes of physical problems.

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Date submitted: 29 Jul 2014 Electronic form version 1.4