1116-65-749 **Joseph Eichholz*** (`eichholz@rose-hulman.edu`). *A New Method for Solving the Obstacle Problem.*

The obstacle problem is a standard example of a variational inequality of the first kind. Variational inequalities naturally arise in a wide range of applications, for example, elastoplasticity, contact mechanics, heat control problems, and options pricing problems in finance. Due to the inequality in the formulation of the obstacle problem, the standard quadratic finite element method only achieves $\mathcal{O}(N^{-3/4+\epsilon})$ convergence, where N is the number of degrees of freedom and $\epsilon > 0$ arbitrary. We introduce a two-grid algorithm for solving the obstacle problem in which we solve the obstacle problem, capture the free boundary, refine the mesh, and solve the problem on a new mesh. We demonstrate that the method has has nearly optimal convergence order $\mathcal{O}(N^{-1+\epsilon})$. Numerical evidence is provided indicating superior performance to standard finite element methods. (Received September 11, 2015)