1086-65-2637 **Maarten de Hoop**, IN, **Lingyun Qiu*** (qiu@purdue.edu), 150 N. University St, West Lafayette, IN 47906, and **Otmar Scherzer**. *A multi-level projected steepest descent iteration for nonlinear inverse problems in Banach spaces subject to stability constraints.*

We consider a class of inverse problems defined by a nonlinear map from parameter or model functions to data. The parameter functions and data are contained in certain Banach spaces. Assuming conditional stability of the inverse problem, that is, assuming that stability holds on a closed, convex subset of the domain of the operator, we introduce a novel nonlinear projected steepest descent iteration and analyze its convergence to an approximate solution given limited accuracy data. We proceed with developing a multi-level algorithm based on a nested family of closed, convex subsets on which stability holds and the stability constants are ordered. Growth of the stability constants is coupled to the increase in accuracy of approximation between neighboring levels to ensure that the algorithm can continue from level to level until the iterate satisfies a desired discrepancy criterion, after a finite number of steps. (Received September 26, 2012)