1116-49-2634 **Noemi Petra*** (`npetra@ucmerced.edu`). *A Fast and Scalable Method for A-Optimal Design of Experiments for Infinite-dimensional Bayesian Nonlinear Inverse Problems with Application to Porous Medium Flow.*

We address the problem of optimal experimental design (OED) for Bayesian nonlinear inverse problems governed by partial differential equations (PDEs). The inverse problem seeks to infer a parameter field (e.g., the log permeability field in a porous medium flow problem) from experimental data observed at a set of sensor locations. The goal of the OED problem is to find an optimal placement of sensors so as to minimize the uncertainty in the inferred parameter field. We formulate the OED objective function by generalizing the classical A-optimal experimental design criterion using the expected value of the trace of the posterior covariance. This OED problem includes as constraints the system of PDEs characterizing the maximum a posteriori probability (MAP) point, and the PDEs describing the action of the covariance (of the Gaussian approximation to the posterior) to vectors. We control the sparsity of the sensor configurations using sparsifying penalty functions, and solve the resulting bilevel optimization problem via an interior-point quasi-Newton method. Numerical results show that the number of PDE solves required for the evaluation of the objective function and its gradient is independent of both the parameter and the sensor dimensions. (Received September 22, 2015)