1135-65-1977 **Noemi Petra*** (npetra@ucmerced.edu), **Alen Alexanderian**, **Omar Ghattas** and **Georg Stadler**. *Optimal control of systems governed by PDEs with random parameter fields using quadratic approximations.*

We present a method for optimal control of systems governed by partial differential equations (PDEs) with uncertain parameter fields formulated as a risk-averse optimal control problem. Conventional numerical methods for optimization under uncertainty are prohibitive when applied to this problem. To make the optimal control problem tractable we invoke a quadratic Taylor approximation of the control objective with respect to the uncertain parameter field. This enables deriving explicit expressions for the mean and variance of the control objective in terms of its gradients and Hessians with respect to the uncertain parameter. We apply the proposed method to a control problem governed by an elliptic PDE with an uncertain coefficient field. We derive adjoint-based expressions for efficient computation of the gradient of the risk-averse objective with respect to the controls and use trace estimation to compute the trace of the Hessian (present in the control objective under the quadratic approximation). We show numerical studies for various aspects of the risk-averse measure and of the efficiency of the proposed method. The results show the effectiveness of our approach in computing risk-averse optimal controls in a problem with a 3,000-dimensional discretized parameter space. (Received September 25, 2017)