1046-49-1923 **Denis Ridzal*** (`dridzal@sandia.gov`), Sandia National Laboratories, Optimization and UQ, P.O. Box 5800, MS 1320, Albuquerque, NM 87185, and **Pavel Bochev**, Sandia National Laboratories, Applied Mathematics and Applications, P.O. Box 5800, MS 1320, Albuquerque, NM 87185. *Scalable Solution Methods via Optimal Control Reformulation.*

We consider an optimization–based approach for the scalable solution of PDE problems comprised of multiple physics operators with fundamentally different mathematical properties. The approach relies on ideas from optimization and control to transform the solution of the composite multiphysics problem into the solution of a sequence of problems governed by scalable components.

The proposed optimization–based framework relies on three essential steps. First, an operator decomposition is applied to the original composite problem, breaking it down into components for which scalable solvers are available. Second, the components are coupled via distributed control parameters, used e.g. in the case of single–domain problems, and/or boundary control parameters, used e.g. in the context of multidomain problems, and a suitable objective functional. Third, the resulting large–scale PDE–constrained optimization problem is solved either directly as a fully coupled algebraic system, or in the null space of the PDE constraints.

We demonstrate the potential of our approach by devising a scalable linear solver for nearly hyperbolic PDEs, which relies solely on the solution of diffusion–dominated problems using algebraic multigrid techniques. Numerical results will be presented. (Received September 16, 2008)