1154-90-1354 **Matt Menickelly*** (mmenickelly@anl.gov), **Jed Brown**, **Yunhui He**, **Scott MacLachlan** and **Stefan Wild**. *Tuning Multigrid Methods with Robust Optimization.*

In the national laboratory system, a significant scientifically-motivated driver of research in mathematics and large-scale computing has historically been the numerical solution of discretized partial differential equations (PDEs). Popular classes of methods for solving such problems include multigrid methods and domain decomposition algorithms. Local Fourier analysis (LFA) is a useful analytical tool to predict and analyze the actual performance of these algorithms. Here, we view LFA as a means to optimize algorithmic parameters (e.g., relaxation weights), to achieve good convergence properties.

This problem can be posed as one of nonlinear (nonconvex) robust optimization, an NP-hard problem. In many settings, there are many algorithmic parameters that must be determined to obtain efficient algorithms - in these cases, an analytical minimizer cannot be computed and approximations from brute-force sampling are intractable. In this talk, we consider using disciplined robust optimization approaches to solve these minimax problems to yield efficient methods that can outperform brute-force sampling. Different examples, with known and unknown analytical solutions, are presented to show the effectiveness of our approach. (Received September 15, 2019)