
Erin Molloy
**Is the ideal approximation operator always “ideal” for a
particular C/F splitting?**

University of Illinois at Urbana-Champaign
Department of Computer Science
emolloy2@illinois.edu
Luke Olson
Jacob Schroder

Given a coarse grid, the ideal prolongation operator is defined by $\mathbf{P}_\star = [\mathbf{W} \ \mathbf{I}]^T$, where the weight matrix, $\mathbf{W} = \mathbf{A}_{FF}^{-1} \mathbf{A}_{FC}$, interpolates a set of fine grid variable (F -points) from a set of coarse grid variable (C -points), and the identity matrix, \mathbf{I} , represents the injection of C -points to and from the coarse grid (Falgout and Vassilevski, 2004). In this talk, we consider \mathbf{P}_\star , constructed from both traditional C/F splittings and C/F splittings corresponding to aggregates, for several challenging problems. We demonstrate the effects of the C/F splitting on the convergence and complexity of \mathbf{P}_\star . Finally, we argue that \mathbf{P}_\star may be misleading in demonstrating the “ideal” nature of interpolation of a given C/F splitting by providing numerical evidence that hierarchies built using \mathbf{P}_\star converge more slowly than hierarchies built from alternative prolongation operators with the same C/F splitting. This is important as we wish to minimize the number of levels in a multigrid hierarchy by using a small set of C points for which \mathbf{P}_\star may have poor convergence.