
James Lai
**Algebraic multigrid for high order hierarchical edge
elements.**

University of Illinois at Urbana-Champaign
Department of Computer Science
201 N Goodwin Ave
Urbana
IL 61801
`jhlai2@illinois.edu`
Luke Olson

We propose an algebraic multigrid (AMG) method for systems discretized by high order $H(\text{curl})$ elements. Standard AMG methods perform poorly on these problems because of the large null space of the curl operator. We use hierarchical high order $H(\text{curl})$ conforming elements. Our algorithm combines ideas from p -multigrid and AMG for edge elements to obtain a high order AMG method. The initial levels in our hierarchy are constructed by discretizing the problem for decreasing orders of p . Since we use a hierarchical basis, the integrid transfer operators are trivial. To address complexity issues, we do not visit every p in our hierarchy. After $p = 0$ is reached, we apply smoothed aggregation AMG for edge elements. We conclude with numerical results for the proposed AMG algorithm applied to the 2D eddy current problem for bases up to order $p = 9$.