

# Adaptive algebraic multigrid methods and Helmholtz decompositions on graphs

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## Abstract

We will focus on one of the modern trends in applications of multigrid, namely, the design of adaptive algebraic multigrid algorithms for graph Laplacians. We review several key results in adaptive finite element theory and practice and show how such techniques can be applied in more general settings to design adaptive multigrid methods without referring to underlying geometrical structures. We further present a couple of adaptive algorithms which construct coarse spaces depending on the right hand side of the linear system. The key ingredient is a Helmholtz decomposition of the graph and localizing the basis for the cycle space. This is a joint work with Xiaozhe Hu and Kaiyi Wu from Tufts University and Ana Budisa, Kent-Andre Mardal, and Miroslav Kuchta from Simula.

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