A Multigrid Approach to Solving Elliptical PDEs

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In this project, we explore the class of algorithms called multigrid methods. These methods although well defined, offer a variety of new insight and unexpected application. Multigrid techniques are based on a sequence of meshes that are obtained by successive refinement in the hopes of smoothing out high frequencies of error. They take advantage of the smoothing property of iterative methods by first using coarse grids to compute an improved initial guess, and using this initial guess in a finer grid. In this nested iterative discretization grid method approach, multi-grid methods are able to obtain relatively good accuracy with a reasonable runtime O(number of unknowns). Our project will not explore the background and development of multigrid's but of course provide an error analysis of this approach. We conclude with an implementation of a multigrid technique in solving both linear and non-linear elliptic PDEs, comparing our final solution to other techniques.