An Exploration of Multigrid Methods

Numerical Methods for PDEs 4301

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Abstract

We used both and one and two dimenssional poisson problems to study multigrid methods for solving partial differential equations. Using iterative solvers for linear systems we show how coarsening the descritization can lead to approximations which converge to the true solution of the PDE with fewer iterations of the solver.

1 Motivation

Error smoothing:

- Brief explanation of aliasing.
- Iterative solvers are smoothers, so they minimize high frequencies first.
- Coarsening the grid allows low frequencies to look like high frequencies.

2 One Dimenssional Problem

2.1 Implementation

2.2 Results

3 Two Dimenssional Problem

3.1 Implementation

3.2 Results

4 Error Analysis

4.1 Multigrid

4.2 Jacobi

5 Conclution

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