A Computational Study of Data Assimilation for a Reaction-Diffusion Equation

An Undergraduate Honors Thesis
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University of Nebraska-Lincoln by

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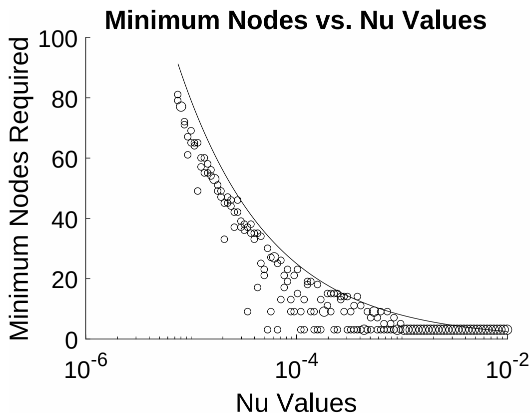

FIGURE 3.1. Minimum number of nodes required for convergence

1. Introduction

Introduction goes here. (Don't write until we are finished.)

2. Preliminaries

Preliminaries section. Put basic lemmas, theorems, and definitions here (i.e., the ones we are going to cite).

Introduce Data Assimilation, the Chaffee-Infante equation, the Eyre convex splitting method

3. Main Section

Main theorems, proofs, and other results go here.

Uniform Static Grid. From 3.1 it seems that the minimum number of nodes can be approximated by

$$M = \frac{1}{4}\nu^{-\frac{1}{2}}.$$

In the worst-case scenario, it seems reasonable that n_b "blobs" are distributed uniformly across the domain. The number of nodes required for data assimilation to capture all of blobs is approximately $2n_b$, or equivalently $n_b = \frac{M}{2}$.

The minimum length of each bump λ is given by the following:

$$\begin{aligned}\lambda &= \frac{L}{n_b}, \\ &= \frac{2L}{M}, \\ &= \frac{2L}{\frac{1}{4}\nu^{-\frac{1}{2}}}, \\ &= 8L\sqrt{\nu}.\end{aligned}$$

By only using data assimilation, we have a heuristic argument for this inverse problem.

Dynamic Placement in Transition Layers.

Data Assimilation by a Sweeping Probe.

Hybrid Methods.

References

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