FYS3150 - Project 1

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Abstract

In this project we will study speed and numerical precision of numerical algorithms. Given a tridiagonal matrix, we used both a general solving algorithm for tridiagonal matrixes and a special taylored 'ferrari' method for our specific problem. This is also compared to a cumbersome LU-decomposition of the matrix.

Using an analytical expression for the diagonal elements in our special case, we were able to reduce the total of computations down to a total of (INSERT N) computations, where N is the number of row and column elements in our matrix.

Contents

Introduction

We will solve the one-dimensional Poisson equation with Dirichlet boundary conditions by reducing it to a set of differential equations on the form of a tridiagonal matrix.

a)

Counting the number of timesteps

There are three different steps to compute:

$$\tilde{a}_i = a_i - \frac{b_{i-1}c_{i-1}}{\tilde{a}_{i-1}} \tag{1}$$

$$\tilde{f}_i = f_i - \tilde{f}_{i-1}\frac{c_{i-1}}{\tilde{a}_{i-1}} \tag{2}$$

$$u_i = \frac{\tilde{f}_i - b_i u_{i+1}}{\tilde{a}_i} \tag{3}$$