

Homework 5
Compact finite differences
due 13/3-2008

Consider an one-dimensional grid with nonuniform distributions of nodes as given in Figure 1.

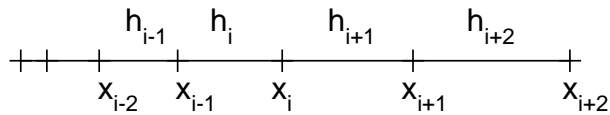


Figure 1: One-dimensional grid with nonuniform distribution of nodes.

Use an approximation of form

$$\alpha_{i-1}f'_{i-1} + f'_i + \alpha_{i+1}f'_{i+1} = a_{i-1}f_{i-1} + a_i f_i + a_{i+1}f_{i+1}.$$

to derive the compact finite difference discretisation for the first-order derivative. Give the relation between coefficients α_{i-1} , α_{i+1} , a_{i-1} , a_i and a_{i+1} which give fourth-order accuracy.