Numerical Methods in Engineering

Your Name

1 Introduction

This document covers the application of numerical methods in engineering.

2 Root-Finding Algorithms

2.1 Newton-Raphson Method

2.2 Example Problem

Use the Newton-Raphson method to find the root of the equation $f(x) = x^2 - 2$ starting from $x_0 = 1$.

Solution

The Newton-Raphson iteration formula is given by:

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}.$$

For $f(x) = x^2 - 2$, we have $f'(x) = 2x$. Starting from $x_0 = 1$, we compute:

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 1 - \frac{1^2 - 2}{2 \cdot 1} = 1 - \frac{-1}{2} = 1.5.$$

Next iteration:

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} = 1.5 - \frac{1.5^2 - 2}{2 \cdot 1.5} = 1.5 - \frac{0.25}{3} = 1.5 - 0.0833 \approx 1.4167.$$

Continuing this process, we can get closer to the root $\sqrt{2} \approx 1.4142$.