

Part I.

METHODS FOR THE SOLUTION OF NON-LINEAR EQUATION SYSTEMS

1. (15) Provide a function for computing square roots within a given error tolerance. Report the number of arithmetic operations per iteration.
2. (25) Provide a function for computing the roots of the polynomial

$$p(z) = z^4 + 4,$$

using Newton's method.

Provide a profile of the attraction-basin structure with five colors. The basin of attraction to each of the four (complex) roots is the region of the initial values which lead to the convergence at the root. The set of points belong to none of these attraction basins is called the Julia set of p .

Select a subdomain to display the fractal appearance.

3. (20) Determination of nonlinear data fitting. Problem 11 Exercise Set 10.2.
4. (15) Comparison of Gauss-Seidel method and Newton's method for the solution of Problem 1 in Exercise Set 11.4.

Part II. (25)

Find the following definitions.

- Elliptic Partial Differential Equations (PDE)
- Parabolic PDE
- Hyperbolic PDE
- Find out which of the above are time dependent.
- Find the categories for the following equations

Poisson equation

Laplace's equation

diffusion equation

wave equation