MA845 INTRODUCTION TO INTERVAL ANALYSIS 4-0-0-4

Unit I

The Interval Number System

Basic Terms and Concepts, Order Relations for Intervals, Operations of Interval Arithmetic, Interval Vectors and Matrices, Some Historical References;

First Applications of Interval Arithmetic

Examples, Outwardly Rounded Interval Arithmetic, INTLAB, Other Systems and Considerations;

Further Properties of Interval Arithmetic

Algebraic Properties, Symmetric Intervals, Inclusion Isotonicity of Interval Arithmetic.

Unit II

Introduction to Interval Functions

Set Images and United Extension, Elementary Functions of Interval Arguments, Interval-Valued Extensions of Real Functions, Fundamental Theorem and Its Applications, Remarks on Numerical Computation;

Interval Sequences

A Metric for the Set of Intervals, Refinement, Finite Convergence and Stopping Criteria, More Efficient Refinements.

Unit III

Interval Matrices

Definitions, Interval Matrices and Dependency, INTLAB Support for Matrix Operations, Systems of Linear Equations, Linear Systems with Inexact Data, More on Gaussian Elimination, Sparse Linear Systems within INTLAB;

Interval Newton Methods

Newton's Method in One Dimension, The Krawczyk Method, Safe Starting Intervals, Multivariate Interval Newton Methods.

Unit IV

Integration of Interval Functions

Definition and Properties of the Integral, Integration of Polynomials, Polynomial Enclosure, Automatic Differentiation, Computing Enclosures for Integrals, Further Remarks on Interval Integration, Software and Further References;

Integral and Differential Equations

Integral Equations, ODEs and Initial Value Problems, ODEs and Boundary Value Problems, Partial Differential Equations.

TEXT BOOKS/ REFERENCES:

1. Ramon E. Moore, R. Baker Kearfott, Michael J. Cloud (2009). Introduction to Interval Analysis, Society for Industrial and Applied Mathematics Philadelphia.
2. Sukanta Nayak and S. Chakraverty (2008). Interval Finite Element Method with MATLAB, Academic Press.