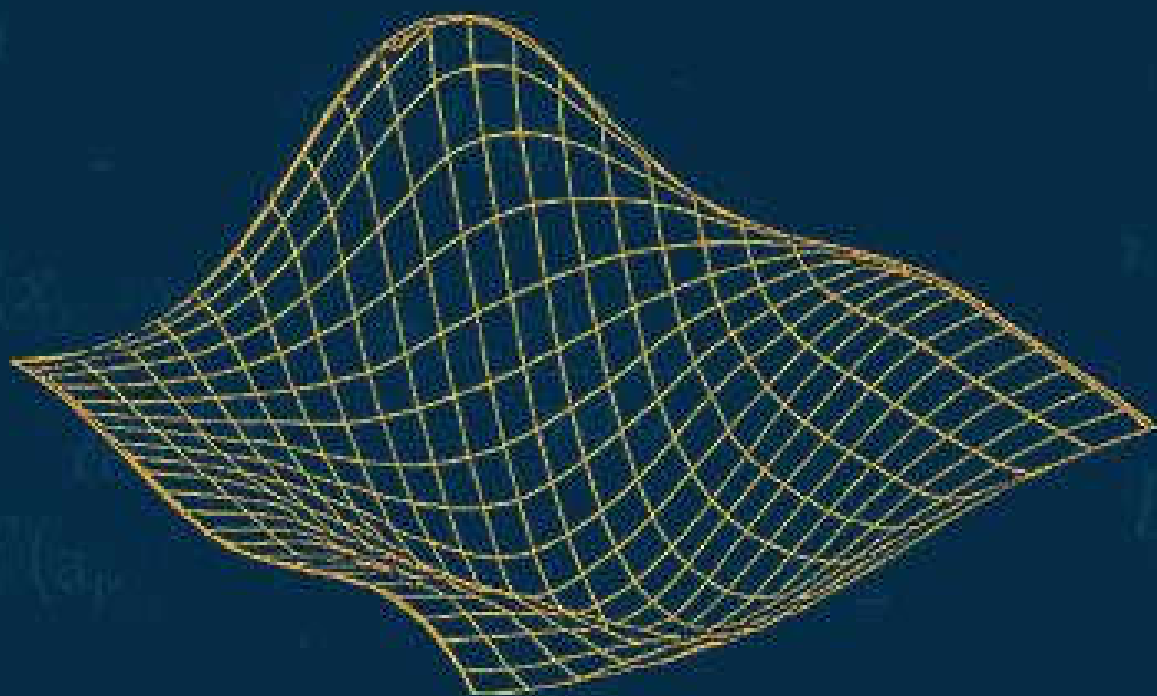


ADVANCED STUDIES IN MATHEMATICS AND STATISTICS

VOLUME-1



EDITOR

MOBIN AHMAD

ADVANCED STUDIES IN MATHEMATICS AND STATISTICS VOLUME-1

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Preface

The field of mathematics and statistics continues to evolve, bridging theoretical advancements with practical applications across diverse disciplines. *Advanced Studies in Mathematics and Statistics-I Volume – I* is a comprehensive volume that brings together cutting-edge research and foundational concepts in these fields, offering a rich resource for researchers, graduate students, and professionals seeking to deepen their understanding of advanced mathematical and statistical methodologies.

This book encompasses a broad spectrum of topics, carefully curated to reflect the dynamic interplay between pure and applied mathematics, as well as statistical theory. The chapters cover a range of subjects, from numerical methods for solving non-linear equations to the intricacies of graph theory, ring theory, and fuzzy optimization. Each chapter is designed to provide both theoretical rigor and practical insights, making the content accessible to those with a strong mathematical foundation while also serving as a reference for specialized research.

The book begins with an exploration of numerical solutions to non-linear equations, presenting classical and fast-convergent methods such as Newton's, Steffensen's, and Halley's approaches. These foundational techniques set the stage for subsequent discussions on optimization, including goal programming and fuzzy optimization models for production planning in uncertain environments. The inclusion of graph theory and fixed-point theory in metric spaces highlights the structural elegance of mathematics, while topics like ring theory, approximation theory, and hypersurfaces in metallic Riemannian manifolds delve into abstract and geometric frameworks.

Statistical methodologies are equally prominent, with a dedicated chapter on the fundamentals of statistics, complemented by advanced discussions on error analysis in interpolation methods and eigen value localization for quaternionic matrices. The book also addresses interdisciplinary applications, such as the study of magnetic field effects on rotating magneto-hydrodynamic (MHD) flows and hypergeometric transformations, which underscore the relevance of mathematics in physical and engineering contexts.

Our aim is to provide a cohesive yet diverse collection of topics that inspire further exploration and research. Each chapter is authored by experts in their respective fields, ensuring depth and clarity. Whether you are a mathematician, statistician, or practitioner in a related discipline, this book offers valuable insights into the theoretical underpinnings and practical applications of advanced mathematics and statistics.

We hope that *Advanced Studies in Mathematics and Statistics-I Volume-1* serves as a catalyst for intellectual curiosity and fosters a deeper appreciation for the beauty and utility of these disciplines. We invite readers to engage with the material, explore its applications, and contribute to the ongoing advancement of mathematical and statistical sciences.

Editor

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Exploring the Accuracy of Interpolation Methods Through Error Analysis

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This chapter includes a brief discussion of interpolation. The Lagrange interpolation polynomial and the Newton's interpolation formula are discussed. Error involved in approximating a function by a polynomial is also discussed, which provides the basis for calculating the error involved in performing numerical integration. The computational complexity, i.e., the number of multiplications and additions involved in using a certain interpolation formula are also discussed.

Introduction to Interpolation:

In practical engineering applications, it is often necessary to derive results in numerical form. For instance, conclusions may need to be drawn from a set of experimental data presented in tabular form, or a system of linear algebraic equations may require a solution. Numerical analysis is concerned with the development of efficient and reliable methods for obtaining numerical solutions to such problems. It is well known that computers and mathematics are two important tools of numerical methods. Prior to 1950, numerical methods could only be implemented by manual computations, but the rapid technological advances resultant in the production of computing machines which are faster, economical and smaller in size. Today's engineers have access to several types of computing systems, viz., mainframe computers, personal computers and super computers. Of these, the personal computer is a smaller machine which is useful, less expensive and, as the name implies, can easily be possessed and used by individuals. Nevertheless, mere possession of a computer is not of great consequence; it can be used effectively only by providing suitable instructions to it. These instructions are known as software. It is therefore imperative that we develop suitable