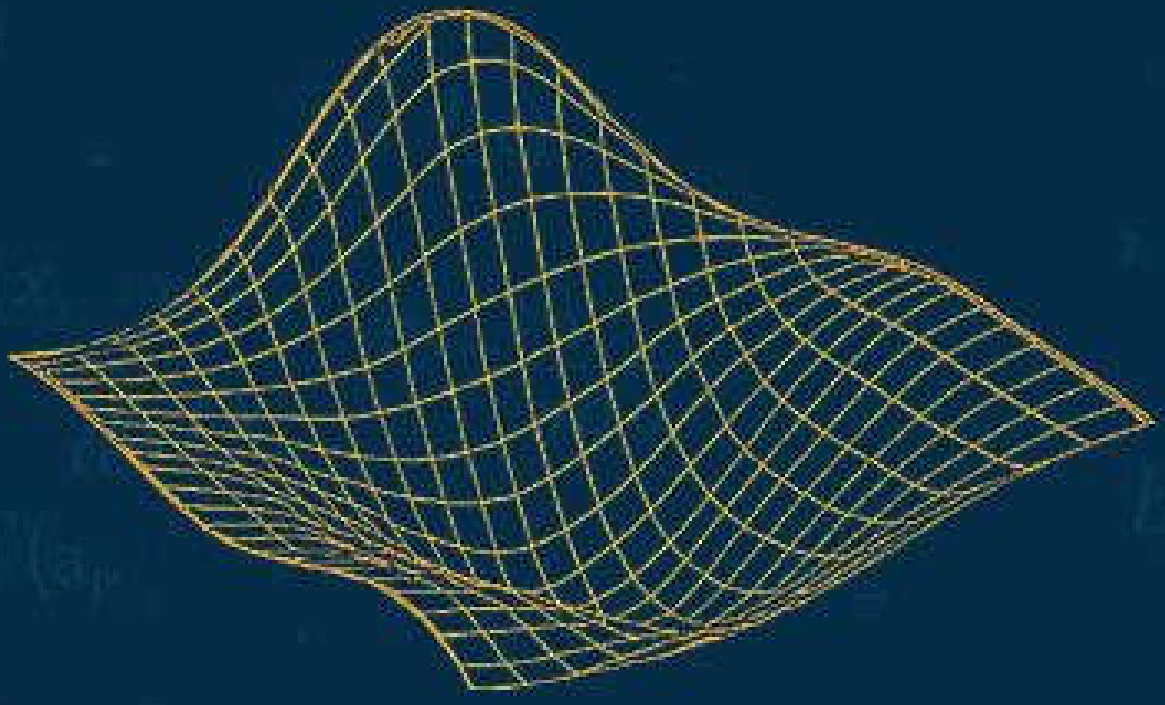
ADVANCED STUDIES IN MATHEMATICS AND STATISTICS

VOLUME-1



EDITOR
MOBIN AHMAD

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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 – 1* 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
Mobin Ahmad
Department of Mathematics & Statistics
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NUMERICAL SOLUTIONS OF NON-LINEAR EQUATIONS BY NEWTON'S, STEFFENSEN'S & HALLEY'S METHODS

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Numerical analysis is the study of algorithms that use numerical approximation for the problem of mathematical analysis. Numerical analysis in mathematics means to solve mathematical problem by arithmetic operation and comparison. The role of numerical method is solving scientific and engineering problems has increased dramatically in modern time. Numerical methods are often used to obtain the approximate solution of such problem because it is not possible to obtain exact solution by using algebraic process.

Problem of the real world have measurement error. So imagine, for example, weather simulation, there are many measurements and the longer we want to predict the weather in the future, the more effects do those errors have. At some point, the error might be too big. We study numerical methods to find better algorithms that cause less error.

In experimental methods, we reproduce the system using full-size or scaled model and obtain the solution by measuring and scaling the relevant characteristics. There is generally an excellent representation of the physical system but the process is typically slow and often expensive. Scaling effects are sometime non-linear and complicated that need to be properly accounted for in the interpretation of result.

The mathematical model representing a physical system may be solved using experimental, analytical and numerical method or a combination of them. However rarely, one does obtain an exact solution because of the approximations introduced in the process at various stages.

Analytical solution, if possible are very useful for understanding the response of the system. However, they are often limited to very simple geometry and finding a solution can often be extremely difficult. Sometimes, the analytical solution may involve