Numerical Analysis: Theory and Experiments

a note from the author

My new book ***Numerical Analysis: Theory and Experiments*** presents rapidly converging numerical methods and develops techniques, both theoretical and experimental, for analyzing them. The book is based on my teaching experiences and important recent developments in the field.

In my own numerical analysis course, I emphasize a multifaceted approach to problem solving. Students are expected to **assess** properties such as smoothness and conditioning, to **predict** performance of numerical methods, to **implement** solutions in computer code, to **measure** rates of convergence with experiments, and to **interpret** results using graphics. The book reflects this structure, interleaving mathematical analysis, computer code, graphics, and discussion. Lab problems from my courses appear as exercises throughout the book, and hundreds of additional exercises support a variety of student needs and course structures.

The outside development that motivated a new book was the recent embrace of **Chebyshev technology** by the numerical analysis community. Compared with older methods, Chebyshev methods can converge **blazingly fast**. However, they also require a more subtle analysis. Whereas many older methods achieve their full potential on functions possessing a few derivatives, Chebyshev methods achieve their full potential on functions that are analytic in the complex plane. My book presents both kinds of methods in parallel from the earliest chapters. This requires additional investment in understanding function **smoothness**, but the benefit is immense; we can achieve geometric or even supergeometric rates of convergence and exhaust the precision of the computer in a fraction of a second.

Numerical Analysis: Theory and Experiments provides hands-on experience with, and careful analysis of, some of the best numerical methods available today.

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