Validated Numerics: A Short Introduction to Rigorous Computations

By Warwick Tucker

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This textbook provides a comprehensive introduction to the theory and practice of validated numerics, an emerging new field that combines the strengths of scientific computing and pure mathematics. In numerous fields ranging from pharmaceutics and engineering to weather prediction and robotics, fast and precise computations are essential. Based on the theory of set-valued analysis, a new suite of numerical methods is developed, producing efficient and reliable solvers for numerous problems in nonlinear analysis. Validated numerics yields rigorous computations that can find all possible solutions to a problem while taking into account all possible sources of error--fast, and with guaranteed accuracy.

Validated Numerics offers a self-contained primer on the subject, guiding readers from the basics to more advanced concepts and techniques. This book is an essential resource for those entering this fast-developing field, and it is also the ideal textbook for graduate students and advanced undergraduates needing an accessible introduction to the subject. *Validated Numerics* features many examples, exercises, and computer labs using MATLAB/C++, as well as detailed appendixes and an extensive bibliography for further reading.

- Provides a comprehensive, self-contained introduction to validated numerics
- Requires no advanced mathematics or programming skills
- Features many examples, exercises, and computer labs
- Includes code snippets that illustrate implementation
- Suitable as a textbook for graduate students and advanced undergraduates

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Review
"Beyond obvious practical value, this material offers students an excellent opportunity to revisit and rethink some crucial, fundamental college mathematics."**--*Choice***

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"*Validated Numerics* contains introductory material on interval arithmetic and rigorous computations that is easily accessible to students with little background in mathematics and computer programming. I am not aware of any other book like it. The exercises and computer labs make it ideal for the classroom, and the references offer a good starting point for readers trying to gain deeper knowledge in this area."**--Zbigniew Galias, AGH University of Science and Technology, Kraków**

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About the Author
Warwick Tucker is professor of mathematics and principal investigator for the Computer-Aided Proofs in Analysis (CAPA) Group at Uppsala University in Sweden. He has been honored with several awards, including the European Mathematical Society's Prize for Distinguished Contributions in Mathematics, the R. E. Moore Prize for Applications of Interval Analysis, and the Swedish Mathematical Society's Wallenberg Prize.

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