

Measurements and their Uncertainties: A practical guide to modern error analysis

By Ifan Hughes, Thomas Hase

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This hands-on guide is primarily intended to be used in undergraduate laboratories in the physical sciences and engineering. It assumes no prior knowledge of statistics. It introduces the necessary concepts where needed, with key points illustrated with worked examples and graphic illustrations. In contrast to traditional mathematical treatments it uses a combination of spreadsheet and calculus-based approaches, suitable as a quick and easy on-the-spot reference. The emphasis throughout is on practical strategies to be adopted in the laboratory.

Error analysis is introduced at a level accessible to school leavers, and carried through to research level. Error calculation and propagation is presented through a series of rules-of-thumb, look-up tables and approaches amenable to computer analysis. The general approach uses the chi-square statistic extensively. Particular attention is given to hypothesis testing and extraction of parameters and their uncertainties by fitting mathematical models to experimental data. Routines implemented by most contemporary data analysis packages are analysed and explained. The book finishes with a discussion of advanced fitting strategies and an introduction to Bayesian analysis.

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Review

"With the shift from analytic methods to spreadsheet-based techniques, this book will enable students simultaneously to (a) become fluent in the choice and application of appropriate methods (b) understand the underlying principles."

--David Saxon, University of Glasgow

About the Author

Ifan Hughes took his BSc at Imperial College London, his DPhil at Oxford University, and undertook post-doctoral research at Oxford, Yale and Sussex. He has been at Durham University since 1999, where he is now a Senior Lecturer.

Thomas Hase has been an Associate Professor at Warwick University since 2007. Prior to that, he did his BSc, PhD and post-doctoral research at Durham University.

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