BOOK REVIEWS

L. Kubáček, L. Kubáčková: STATISTICS AND METROLOGY (STATISTIKA A METROLOGIE). University Palacký Press, 2000, 307 pages. In Czech.

The book is primarily intended for those who are interested in the applications of statistics in experimental physics and metrology. It can also serve as a textbook for postgraduate studies in these disciplines. The authors believe that it could become a useful tool for designing experiments in other disciplines, too. However, the text is specifically focused on metrology to be of use for applications in e.g. economics, biology, medicine, agrobiology. Reading the book assumes a basic knowledge of calculus, statistics, probability, matrix calculus, and the ability of smooth reading of matrix text.

The main theme of the book are linear statistical models, on which the authors based the modeling of experimental situations and, with an accompanying assumption of normal distribution of errors, the construction of confidence regions and tests of statistical hypotheses. Nonlinear models are approximated chiefly by a linear model using the Taylor expansion.

The initial three chapters (I. Experiment, II. The statistical characteristics of measurement techniques, III. The design of the experiment) are introductory ones, where the experimental work ethics and the goals of the experiment are briefly discussed. Basic probability and statistical concepts and techniques are introduced there with elucidation of their meaning and use. The importance of the role of normal distribution in applications is documented by quoting central limit theorems. The notions of accuracy, reliability, repeatability and especially of the linear model and the experimental design are defined here together with the optimality criteria of experimental design, with the analysis of their meaning and the iterative method of construction of the optimal design.

The next two chapters (IV. Basic linear measurement models, V. Models of special structure) are devoted to properties and applications of the linear model. The theory of estimation of parameters and the tests of statistical hypotheses in the linear model are widely treated. Considered are BLUE, UBLUE, LBLUE, MINQUE, UMVQUIE, LMVQUIE estimates, and their existence and all their properties are proved in detail. Applications gather polynomial regression (including the method of orthogonal polynomials), estimation of parameters of the calibration curve, replicable models and etalon networks. Discussed are linear models with nuisance parameters and models with special covariance structure (e.g., the covariance matrix is a linear combination of known covariance matrices).

In the final chapter (VI. Nonlinear structure models) the theory of linear model, outlined in previous chapters, is applied to models nonlinear in parameters. The main tool is the use of approximate linearization of the nonlinear model by means of the Taylor expansion. A deeper attention is paid to the study of the effect of the approximation on biasedness of the parameter estimates.

The authors assembled extensive material on linear models and their use for approximation of nonlinear models. The book can therefore be recommended as a suitable source of knowledge to those who have deeper interest in these disciplines.

Jiří Vondráček

D. Bachman: A GEOMETRIC APPROACH TO DIFFERENTIAL FORMS. Birkhäuser-Verlag, Boston, 2006. ISBN 978-0-8176-4499-4, 133 pages, price EUR 32,00.

The book is dedicated to a very interesting, but rather difficult area involving differential forms, integration and the Stokes theorem. There are two ways how such topics are usually explained. Authors either use "engineering" approach with lots of illustrative but vague and even incorrect arguments, or stick to "truly mathematical" formalism, which does not give the reader a feeling of real understanding. In this book, as the title suggests, the author tries to get geometrical imagination involved as much as possible, together with keeping everything correct. This goal is fully achieved in the first part, which may serve as a good introduction to multivariable calculus and parametrizations. The text looks almost like a story, which may be irritating for readers used to "definition-theorem-proof" style, but can be very inspiring at least for undergraduate students.

The following, more demanding part of the book deals with differential forms and their properties. Even though geometrical imagination is much more complicated and more formalism is needed, the author tries to keep the text as readable as possible. For example, integration of differential forms is first shown for two simple examples, then generalized into a formal theorem, which is then used to derive substitution theorems in 1D. The whole machinery of differential forms is finally used to derive the Stokes theorem and show its applications in vector calculus, Maxwell's equations and other areas.

Even though later chapters do not offer any really innovative approach to the subject and the geometrical insight does not go as far as in the initial, more elementary part (and it is arguable, whether it is possible at all), the book as a whole can be recommended for all readers who want to gain deeper understanding of the area.

Pavel Kůs