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Book Reviews

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Wimmer, G. — Palenčár, R. — Witkowský, V.:
DATA PROCESSING IN MEASUREMENT.
Veda, Bratislava 2002, 189 pp.
ISBN 80-224-0734-8

This book is written essentially for people having to do with applications of mathematical statistics in metrology. Therefore the authors chose to present even a part of the theory in form of 40 examples discussed up to numerical details. The importance of examples in the book is illustrated also by the fact that from the 187 pages of the text more than 65 pages are examples, and 18 pages contain statistical tables of the normal, Student and triangular distributions.

The book is divided into three parts. In the center of the first part is what they call the stochastic model of measurement, where the relation between the observed variables and the unknown parameters are supposed to be given implicitly, in form of some (in general nonlinear) equations with additional constraints on the parameters. However, from the very beginning these relations are linearized with respect to the parameters, using the first order Taylor formula, and neither higher order approximations nor the errors coming from this linearization are considered. So in fact the linear model with linear parameter constraints is considered in the whole book. Eventual systematical errors are usually also modelled randomly by a uniform or by a normal distribution. For the sake of applications, particular cases are considered separately in details: the case of direct measurement of one variable (= the linear models with a unidimensional parameter), the indirect measurement of one or several variables, the direct resp. indirect measurement of several variables with constraints. In each case the Gauss-Markov estimator, and eventually the confidence regions under the assumption of normal errors are considered, but the stress is on the many examples presented here. Of particular interest are examples of comparison and calibration of etalons in metrology, which are treated from different aspects. Important is here also the training of the skill to work with matrices in the multivariate cases.

The second part of the book deals with the influence of rounding of observed variables on the estimation of the parameters. In the literature the effect of rounding is not very often considered: well known is the influence on the moments (Sheppard's corrections) described in the classical book by H. Cramér, there are researches on rounding in elections by voting, etc., however, the approach of the authors is different and is specific for metrology. In the main lines one can say that they use the fact that rounding the observed values up to a given number of valid figures, with a simultaneous rounding of standard errors on a given order, leads to some non-random bounds on the difference between the standardized rounded and not rounded observed variables. So they obtained bounds for the confidence of some modified (simple for use) confidence region for parameters, and they developed further their approach in the case of normally, uniformly or triangularly distributed errors. At the end of this second part of the book an exposition on the actual ISO rules for rounding in metrology is added.

The third part of the book are Supplements. Besides a basic exposition on matrix properties and elements of probability and statistics it contains also an exposition of the standard terminology in metrology and statistical tables. A list of symbols is at the beginning, and an index at the end of the book.

Evidently, the aim of the authors was to approach advanced theoretical results to people in applications. Their exposition of the subject through a combination of a strictly mathematical text and of examples is successful, and I suppose that the book will be well accepted not only by people working with data in metrology, but also by all statisticians who want to have a good multivariate training on realistic examples.

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