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Book review
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Aerodynamic Measurements: From Physical Principles to Turnkey Instrumentation

G. P. Russo. Woodhead Publishing, Cambridge, UK, 2011, ISBN 978-1-84569-992-5, £125, 282 pp.

During the past few decades, significant numerical developments have been undertaken in the fields of basic and applied aerodynamics, including unsteady three-dimensional turbulent computations such as direct numerical, large-eddy or detached-eddy simulations. Critically the validation of a numerical model relies upon independent data sets that were not used during the verification and calibration of the model. Several researchers discussed the intricacy of the validation process: for example, Mehta (1998), Roache (1998), Rizzi and Vos (1998), Sagaut *et al.* (2008) and Chanson and Lubin (2010). In a complex hydrodynamic flow, the model outputs must be compared with the detailed pressure, velocity and temperature distributions in the system. A key challenge is the uncertainty which exists in all physical systems. The experimental data are subjected to an intrinsic uncertainty, caused by a combination of technological limitations and accuracy of the post-processing tools. The same applies to the numerical data, which are subjected to modelling, numerical and round-off errors, and whose optimal values of various parameters of interest may be biased (Sagaut *et al.*, 2008). Although an uncertainty analysis must be carried out for both physical and numerical data, many computational fluid dynamic (CFD) analyses fail to address the problem (Roache, 1998, 2009). Often a key issue is the absence of suitable physical data to validate these analyses. And this brings me to the book *Aerodynamic Measurements: From Physical Principles to Turnkey Instrumentation* by Guiseppe Russo.

Aerodynamic Measurements is all about physical measurements. This is a no-nonsense book about experimental techniques in aerodynamics. The contents are based upon the extensive experience and expertise of the author, and this book is a great service to the research community. Being involved as an expert-consultant, a lecturing staff and a researcher in applied fluid mechanics, I congratulate the author for his efforts in emphasising the intricacy of experimental techniques for a wide range of flow fields, including steady and unsteady flows, incompressible and compressible fluid motion, and one-, two- and three-dimensional fluid flows. The book is a superb illustration of the difficulties associated with the physical measurements and instrumentation, and it brings expert advice and information to solve numerous practical situations.

The book does not waste time. There is no introduction and conclusion. The treatise is divided into seven chapters covering a wide range of techniques: pressure measurements, velocity measurements deduced from pressure data, hot-wire anemometry, laser anemometry, temperature measurements, flow visualisation and force measurements. The book covers a wide range of relevant topics. It has been clearly written by an expert in these issues. For example, the chapter on flow visualisation is very good, complete and useful; the sections on velocity measurements include a wealth of information that is most up to date. The title says it all: 'from physical principles to turnkey instrumentation', from the fundamentals to the design and manufacturing instruments up to their ready-made usage by the researchers. Overall the treatise covers a broad range of topics not often discussed in fluid mechanics textbooks. Each chapter is very practical and researchers will find an appropriate level of details including relevant references. The book is supported by a good index and superb illustrations, of both photographic and schematic nature. The format of the book (i.e. 234 × 156 mm) is very handy.

In a spirit of constructive comments, I feel that a number of relatively minor issues should be considered for the next edition. For example, the bibliography could be extended in several chapters; a discussion on dynamic similarity, dimensional considerations and physical modelling should be added; a section on scalar measurements could be considered.

Overall, I recommend strongly this book. It is best suited to advanced postgraduate students and research professionals involved in physical modelling and experimental techniques.

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