

Book Reviews

Low-Speed Wind Tunnel Testing, Third Edition

Jewel B. Barlow, William H. Rae Jr., and Alan Pope, Wiley, New York, 1999,
713 pp., \$89.95

The third edition of this book has been substantially expanded by a new coauthor, Jewel B. Barlow. It is clear that Barlow, who is a scholar of low-speed wind-tunnel testing, has drawn upon his many years of experience for his contributions to this book. Much practical information is shared in this well-written and well-organized book. Every low-speed wind-tunnel engineer should have access to a copy. The price is reasonable; a photocopy of this book would cost almost as much.

As stated in the Preface, "The scope of the book remains the same as in earlier editions: to help students taking a course in wind tunnel experimentation and to furnish a reference source to wind tunnel engineers and others who use wind tunnels . . ." The book meets these objectives; material is explained clearly at a level understood by an advanced undergraduate aerodynamics student and yet is presented in enough detail to be a reference to experienced wind-tunnel engineers.

This expanded edition has 18 chapters and considerably more material, as compared with the 9 chapters in the second edition. The Introduction now includes a handy discussion of the basic fluid dynamic and aeroacoustic equations as well as the similarity basis for wind-tunnel testing. Some discussion of aeroacoustic testing using the wind tunnel is interspersed throughout the book where appropriate. Chapter 2 describes representative wind tunnels of various types and uses, as was included in earlier editions. Wind-tunnel design in Chapter 3 is discussed in more detail than in the second edition. This will surely prove to be useful to designers of future wind tunnels and to those trying to improve the performance of existing facilities.

Chapter 4 tells the novice how to make pressure, flow, and shear stress measurements. In addition to manometers and pressure transducers, pressure-sensitive paints are discussed. Elements of pressure probe, hot-wire, laser-Doppler, and particle image velocimetry techniques are presented. In addition to Preston tubes, recent developments in liquid crystal techniques for shear stress measurements are discussed. The important subject of flow visualization is placed in proper perspective in Chapter 5. The differences between path-, streak-, stream-, and timelines are carefully described so that users are alerted to the possible pitfalls of misinterpreting flow visualization pictures. Procedures for performing surface flow visualization and examples are given in some necessary detail. The reader benefits from the many years of the authors' experience. Flowfield visualization techniques such

as smoke, smoke wire, and helium-filled bubble methods are also described. Chapter 6 deals with the calibration of the wind tunnel using the measurement techniques of Chapters 4 and 5.

Chapter 7 gives a representative sample of force and moment balance and model-mounting techniques that are currently used. The pros and cons of mounting a model in a given way are presented. The issues of how to handle tares and interference are also addressed. Because most wind-tunnel tests are conducted with scale models, Chapter 8 deals with scale effects. It is frequently necessary to "trip" the boundary layer on a model to simulate higher Reynolds numbers. Much practical advice is given on selecting the trip type and size. The relationship of model scale results to full-scale results is also discussed.

Chapters 9–11 deal with the nature and description of the various wind-tunnel test-section boundary corrections that must be considered in any wind-tunnel test of a model. Corrections for the various types of conditions and types of tests are discussed. Chapter 12 is new to this book. It is a handy presentation of experimental uncertainty concepts, advice on the design and planning of wind-tunnel experiments, and model-building issues. Chapter 13 deals with the testing of aircraft and their individual components.

Two of Barlow's students drafted the new Chapters 14 and 15, which deal, respectively, with the special application of wind-tunnel testing to ground vehicles and marine vehicles, including sailboats. Both applications have increasing importance to wind-tunnel testing, given the desire to reduce flow noise around passenger cars and the popular interest in racecars and pleasure boats. Discussion is also devoted to the testing of models of large naval and maritime vessels. Chapter 16 presents some wind engineering uses and the requirements for the approach atmospheric boundary layer in such tests. Chapter 17 describes small wind tunnels that are used for probe calibration, instruction, the study of boundary layers, and other special uses. The new Chapter 18 describes some of the issues involved in performing unsteady model motion or dynamic tests.

On the whole, this book is a very good addition to the aerodynamicist's personal library. About the only shortcoming that I could find was the occasional lack of cited references that could lead the reader to more detailed information on a given topic.

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