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Book Reviews

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IUTAM Symposium on One Hundred Years of Boundary Layer Research

Edited by G. E. A. Meier and K. R. Sreenivasan, Springer, Dordrecht, The Netherlands, 2006, 494 pp., $199

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THE boundary-layer theory first set forth by Ludwig Prandtl in 1904 is a cornerstone of fluid mechanics. All introductory courses in fluid dynamics develop the theory on the basis of the same physical reasoning used by Prandtl. More advanced courses repeat that reasoning but then exploit the physical ideas underlying the theory within the context of the method of matched asymptotic expansions, a method that permits a systematic treatment of effects not readily deduced on the basis of such reasoning. These further developments of boundary-layer theory embellish the significance and importance of Prandtl's original concept.

The volume under review is the proceedings of an International Union of Theoretical and Applied Mechanics (IUTAM) meeting held at the DLR, German Research Center in Göttingen on 12–14 August 2004 to commemorate the 100th anniversary of the presentation by Prandtl of his boundary-layer theory at a congress of mathematicians in 1904. At the time, Prandtl was Professor of Mechanics at the Technical College of Hannover. We are told that the audience at the congress was not impressed by the paper, because the essence of the idea of the boundary layer is not mathematical. However, Felix Klein, the famous mathematician at the University of Göttingen, did not share this lack of enthusiasm and had Prandtl appointed to the faculty of the University of Göttingen, where he spent the remainder of his life, including the period of two world wars. There, he further developed his boundary-layer theory and made many contributions to fluid and solid mechanics, gas dynamics, turbulence, and aerodynamics. The lifting-line theory, the Prandtl–Karman law of the wall, the Prandtl–Meyer flows, and the Prandtl–Glauert rule are a few examples of these contributions. Many of his doctoral students went on to distinguished careers and became well known in their own right. Prandtl died in 1956.

In the proceedings under review, 42 papers and 5 posters set forth recent advances in boundary-layer theory. The first, one of the most interesting, is a review by G.E.A. Meier of Prandtl's work leading to his boundary-layer theory and to its further extensive development at Göttingen. Included are informative graphs and flow photographs from Prandtl's early papers. With its focus on various aspects of the development of boundary-layer theory, little attention is devoted to the many other scientific areas to which Prandtl made important contributions. However, some are suggested by the history of experimental facilities built at Göttingen under Prandtl's direction.

The papers in the proceedings are assembled in six sessions, with labels providing indications of the topics covered. They are Classification, Definition and Mathematics of Boundary Layers; Instability of Boundary Layers and Transition; Boundary Layer Control; Turbulent Boundary Layers; Numerical Treatment and Boundary Layer Modelling; and Special Effects in Boundary Layers. The authors of the papers in this volume are leading contributors to the field and provide a mix of large-scale computation, theory, and experiment. In keeping with the commemorative nature of the meeting, several papers provide useful and interesting historical perspectives on developments related to the boundary layer. For example, H. Fernholz reviews "...the most important measuring techniques..." for "...skin-friction in boundary layers with pressure gradients." Clearly, this volume provides a valuable report on the current status of one of the most important concepts in fluid mechanics.

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