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BOOK REVIEW

FLOW AROUND CIRCULAR CYLINDERS. VOLUME 1 (FUNDAMENTALS), M. M. Zdravkovich, Oxford University Press: Oxford.

This book is the first volume in a two-volume encyclopaedic work covering all aspects of flow past circular cylinders. The author has spent most of his professional life studying the subject and probably has, as a result, a more comprehensive knowledge of it than anyone else in the field. Volume 1, which has been published and is being reviewed here, deals with the basic physics, while Volume 2 which is not yet complete will deal with applications.

The book (Volume 1) is organized into three parts. Part A describes the whole Reynolds number range of incompressible cross-flow past nominally smooth, infinite span, circular cylinders, Part B, theoretical and numerical simulations of these flows and Part C, real flow effects: free-stream turbulence, compressibility and so on. This sub-division is very helpful. As with all complex subjects, one can have different preferences and in my opinion the grouping is not entirely logical. Surface roughness effects which are close to primary Reynolds number and free-stream turbulence effects, and finite-aspect ratio effects which with incident shear are related to the development of three dimensionality might better have been kept together, delaying the sections on compressibility, heat transfer, cavitation and aerodynamic sound until Volume 2.

The first part of the book sets out the incompressible-flow regimes, in terms of the primary parameter Reynolds number, clearly and comprehensively. The flow physics is described for each providing an excellent survey, which any student wishing to study circular-cylinder flows would do well to read. In a book of this scope which deals with a subject under current development, it is inevitable that the coverage of some topics will appear incomplete by the time the book has been published. There are a few cases of this. The development of three-dimensional instability and eventual transition to turbulence in the laminar wake is an example which is discussed, but not as fully as could now be possible. Overall, however, the descriptions of the basic flow regimes cover the important phenomena in each regime well.

The theoretical part, Part B, presents the classical and some more recently computed flow solutions. Attached and symmetric separated laminar flow solutions are described up to the high Reynolds number results of Smith and of Fornberg. The laminar vortex street regime is more difficult to deal with, because many different sets of results have been computed and there is still not total agreement about the exact values of some of the basic quantities such as mean drag coefficient. The survey of the state of these computations is inevitably truncated and some major issues such as the correct simulation of turbulence in a wake are not dealt with. The discrete-vortex method which has also been widely used for bluff-body flow simulation is given rather more prominence here as a means of simulating the vortex street although the more conventional finite difference, volume or element, methods are widely used and more so in general engineering applications.

The final part (C) deals with departures from the "ideal" case of incompressible flow past an infinite span, smooth circular cylinder. As said earlier, the difficult choice of which cases to include in this section of Volume 1 and which to defer to Volume 2 may not be universally agreed. However, the topics presented are dealt with comprehensively,

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particularly the sections dealing with free-stream turbulence and shear (which possibly reflect the fact that for these the body of knowledge is not changing rapidly and, hence, any survey will remain more current). The book does contain a number of minor typographical errors including a consistent discrepancy in the equation number references probably due to chapter renumbering.

The circular cylinder is almost certainly the most widely studied body in fluid flow because of the simplicity of the geometry coupled with the large number of different flow phenomena and regimes which such a simple geometry is able to generate. The author of this book is probably the only person who could have attempted such a comprehensive study much of it based on detailed personal knowledge. The criticisms raised above are inevitable in a book of this scope, in a continually developing field and the author is to be congratulated on producing such a useful work, including the very comprehensive and well-organized bibliography. The book, and its companion in due course, will be an essential reference for anyone researching or wishing to learn about this fascinating subject.

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