



Vorticity and Vortex Dynamics

By Jie-Zhi Wu, Hui-yang Ma, M.-D. Zhou

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This book is a comprehensive and intensive monograph for scientists, engineers and applied mathematicians, as well as graduate students in fluid dynamics. It starts with a brief review of fundamentals of fluid dynamics, with an innovative emphasis on the intrinsic orthogonal decomposition of fluid dynamics process. This is followed by vortex dynamics dealing with the motion, interaction, stability, and breakdown of various vortices. Typical vortex structures are analyzed in laminar, translational, and turbulent flows, including stratified and rotational fluids. In another chapter vortical flow management is presented, such as diagnostics and control. Physical understanding of vortical flow phenomena and mechanisms is the first priority throughout the book. To make the book self-contained, some mathematical background is briefly presented in the main text, but major prerequisites are systematically given in appendices.

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Vorticity and Vortex Dynamics By Jie-Zhi Wu, Hui-yang Ma, M.-D. Zhou Bibliography

- Sales Rank: #2218549 in Books
- Published on: 2006-05-06
- Original language: English
- Number of items: 1
- Dimensions: 6.14" h x 1.63" w x 9.21" l, 2.82 pounds
- Binding: Hardcover
- 776 pages



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Review

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"The overall organization and writing style of the book is good and the authors make their best effort to present the material in a systematic and coherent fashion, so that readers can grasp the concepts quickly. This book will be 1) an excellent source of material for selected topics in graduate classes on fluid mechanics, 2) a good book for an advanced graduate class on vortex dynamics, and 3) a nice reference book for fluid mechanicians, practicing engineers and scientists." (Kumar M. Bobba, AIAA Journal, Vol. 44 (12), December, 2006)

"Every new book about behaviour of vortices attracts the interest because it surely contains many supplementing and new ideas. ... contains detailed Appendix with additional information about Vector and Tensor Analysis. ... is a valuable and welcome in the area of theory of vortices. ... is very rich in substance. ... The book is recommended to graduate students, engineers and numerical analysts working in the field of mechanics, aerospace, and computational fluid mechanics." (Mikhail Konstantinov, Zeitschrift für Angewandte Mathematik und Mechanik, Vol. 87 (5), 2007)

From the Back Cover

This book is a comprehensive and intensive monograph for scientists, engineers and applied mathematicians, as well as graduate students in fluid dynamics. It starts with a brief review of fundamentals of fluid dynamics, with an innovative emphasis on the intrinsic orthogonal decomposition of fluid dynamic process, by which one naturally identifies the content and scope of vorticity and vortex dynamics. This is followed by a detailed presentation of vorticity dynamics as the basis of later development. In vortex dynamics part the book deals with the formation, motion, interaction, stability, and breakdown of various vortices. Typical vortex structures are analyzed in laminar, transitional, and turbulent flows, including stratified and rotational fluids. Physical understanding of vertical flow phenomena and mechanisms is the first priority throughout the book. To make the book self-contained, some mathematical background is briefly presented in the main text, but major prerequisites are systematically given in appendices. Material usually not seen in books on vortex dynamics is included, such as geophysical vortex dynamics, aerodynamic vortical flow diagnostics and management.

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