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Understanding Aerodynamics: Arguing from the Real Physics

By Doug McLean



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Understanding Aerodynamics: Arguing from the Real Physics By Doug McLean

Much-needed, fresh approach that brings a greater insight into the physical understanding of aerodynamics

Based on the author's decades of industrial experience with Boeing, this book helps students and practicing engineers to gain a greater physical understanding of aerodynamics. Relying on clear physical arguments and examples, Mclean provides a much-needed, fresh approach to this sometimes contentious subject without shying away from addressing "real" aerodynamic situations as opposed to the oversimplified ones frequently used for mathematical convenience. Motivated by the belief that engineering practice is enhanced in the long run by a robust understanding of the basics as well as real cause-and-effect relationships that lie behind the theory, he provides intuitive physical interpretations and explanations, debunking commonly-held misconceptions and misinterpretations, and building upon the contrasts provided by wrong explanations to strengthen understanding of the right ones.

- Provides a refreshing view of aerodynamics that is based on the author's decades of industrial experience yet is always tied to basic fundamentals.
- Provides intuitive physical interpretations and explanations, debunking commonly-held misconceptions and misinterpretations
- Offers new insights to some familiar topics, for example, what the Biot-Savart law really means and why it causes so much confusion, what "Reynolds number" and "incompressible flow" really mean, and a real physical explanation for how an airfoil produces lift.
- Addresses "real" aerodynamic situations as opposed to the oversimplified ones frequently used for mathematical convenience, and omits mathematical details whenever the physical understanding can be conveyed without them.



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
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Editorial Review

Review

“As someone who has been involved with aerodynamics for more years than I care to remember, I have rarely come across a book that is so readable and that provides so many (to me a least) genuinely new insights into the subject and its applications. This book should be high on the wish list of any practising aerodynamicist, whether in industry or academia.” (*Aeronautical Journal*, 1 August 2013)

“This is a sophisticated book for people immersed in the study of fluid dynamics and aerodynamics; it will give them in-depth knowledge of both the physical phenomena and the mathematical equations that are used to describe and predict these phenomena. Summing Up: Recommended. Graduate students in aerospace engineering, researchers/faculty, and aircraft design professionals.” (*Choice*, 1 July 2013)

“Based on the author’s decades of industrial experience with Boeing, this book helps students and practicing engineers to gain a greater physical understanding of aerodynamics. Relying on clear physical arguments and examples, Mclean provides a much-needed, fresh approach to this sometimes contentious subject without shying away from addressing "real" aerodynamic situations as opposed to the oversimplified ones frequently used for mathematical convenience.” (*Expofairs.com*, 11 March 2013)

From the Back Cover

A real understanding of aerodynamics must go beyond mastering the mathematical formalism of the theories and come to grips with the physical cause-and-effect relationships that the theories represent. In addition to the math, which applies most directly at the local level, intuitive physical interpretations and explanations are required if we are to understand what happens at the flowfield level. This book aims to promote such physical understanding.

Understanding Aerodynamics: Arguing from the Real Physics provides a more thorough review of the physical underpinnings of fluid mechanics than is typical of conventional aerodynamics books, and it covers topics specific to aerodynamics with greater physical rigor. Many of the discussions and explanations in the book are novel in the sense that they attempt to remedy incompleteness or inconsistencies in previously available sources. Examples include the discussion of how aerodynamics fits in with modern physical theory in general, the explanations and discussions of the "induction" fallacy, the effect of surface roughness on turbulent skin friction, the basic mechanism for the lift on an airfoil, and the global pressure and momentum-flux balances in the flowfield around a lifting 3D wing.

This book provides:

- An understanding of what the equations and theories of aerodynamics really mean
- Real physical explanations for aerodynamic phenomena such as lift
- Discussions of important topics that are often missing in other aerodynamics books, such as three-dimensional flow in boundary layers
- A broad view of the field and how it all fits together

Understanding Aerodynamics: Arguing from the Real Physics meticulously captures the results of the

author's decades of pondering, discussing, and arguing the physical aspects of aerodynamic flows and is sure to help practicing engineers, as well as students, to gain a greater physical understanding of aerodynamics.

Users Review

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Marc Gaul:

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James Peterson:

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