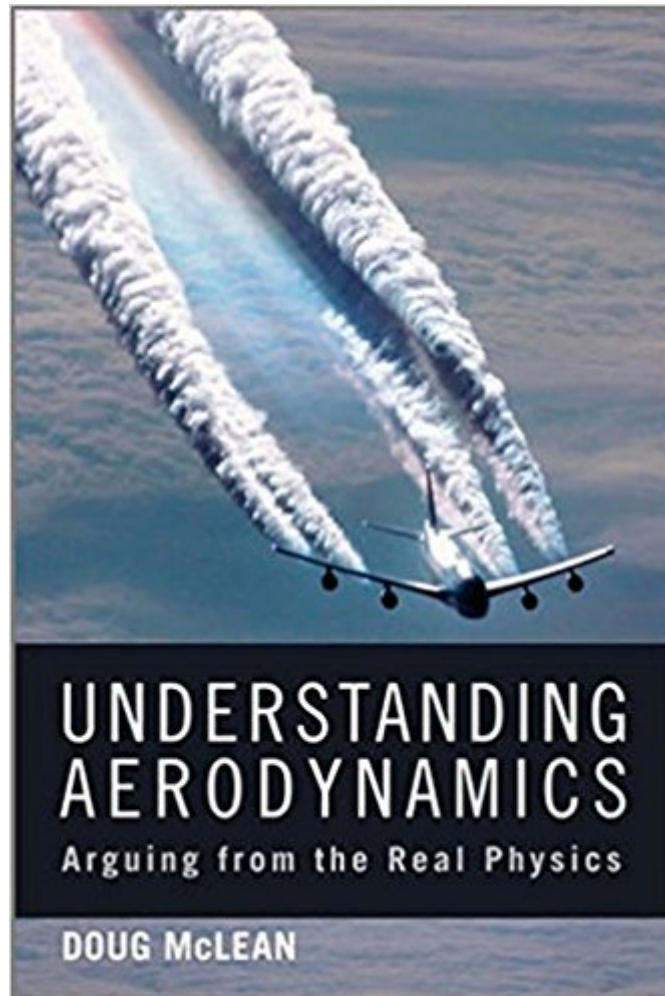




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# Understanding Aerodynamics: Arguing From The Real Physics



## Synopsis

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 the 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.

## Book Information

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## Customer Reviews

“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 at 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)

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 a three-dimensional flow in boundary layers A broad view of the field and how it all fits togetherÂ 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.

Too often aerodynamics has been treated as applied mathematics. This is akin to force the learning of English by committing to memory English grammar rules that the vast majority of native speakers never think about. This has an effect of discouraging anyone but the most unusual students. This book, along with Ed Obert's Aerodynamic design of transport airplane, published in 2009, are important and refreshing in that both are highly informative but not math heavy. Obert's book is one of experience. McLean's book, however, tackles the theory of aerodynamics from a physical point of view. It enhances your understanding of the fundamentals, which is a necessary part of an aerodynamicist's know-how. Only by combining a strong background in theory and all-around experience can an aerodynamicist hope to function in today's highly competitive aircraft manufacturing business. I sincerely recommend this book to people who have long lost hope in a pure mathematical and lifeless approach.

Understanding Aerodynamics is a new approach at explaining why various aerodynamic characteristics take place. Most aerodynamics textbooks use experimental data and theoretical developments to explain aerodynamics, but there are very few equations or theories developed here. The basis is an understanding of the physical mechanisms that lead to lift and drag, which is a refreshing and important contribution. The downside is that the author tends to throw out many classic theories because they can't explain all details of aerodynamics: my response to that is to quote the well-used statement "all theories are wrong, but some are useful." Just because a theory isn't perfect (and none of them are) doesn't mean the theory can't be useful and important. What the author should concentrate on, perhaps, is that we should never confuse our theories with reality, and I think that is an important contribution.

Very in-depth discussion of the complex interactions in aerodynamics. Difficult to verbalize this subject but Doug McLean does a commendable job!

Great information for those interested in the mechanics of flight. Highly recommended.

This book, for an aero engineering student, will feel like a light read. Purchase this and put it on your shelf. You will enjoy its coverage of the fundamentals and find yourself referencing it from time to time to clarify things. I don't personally know the author but my colleagues at Boeing speak to his knowledge in the field of aerodynamics. Cited this text several times in my MS thesis.

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