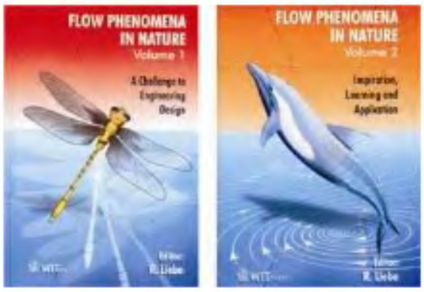

Flow Phenomena in Nature: Volume I – Challenge to Engineering Design; Volume II – Inspiration, Learning and Application. R. Liebe (ed.). WIT Press, Ashurst Lodge, Ashurst, Southampton, SO407AA, UK. 2007. 372 and 432 pp. (vols I and II). Price: US $235 each.

Since time immemorial man has been engaged in a fascinating duel with nature. While many of our modern scientific and technological advancements have been either directly or indirectly influenced by nature, we are yet to resolve its untold mysteries. In many ways, the designs in classical aerospace engineering have been influenced by bird flight, including the current hot research topic of designing unmanned micro/mini-air vehicles. In this backdrop, it is timely and justified that these two volumes elucidating the flow phenomena in nature have been published, particularly in memory of Wolfgang Liebe, who needs no introduction to researchers in the area of unsteady aerodynamics. Well-known researchers have contributed to this compendium of articles on various topics of fluid mechanics and dynamics that have been directly or indirectly influenced by nature.

The various intricacies of engineering design influenced by flying ash, flight of seeds, mammals, amphibians, reptiles and the more popular birds have been lucidly brought out in Volume I. One of the striking aspects of this book is the effort put in by individual authors to address fundamental principles governing different practical applications. In fact, various aspects of unsteady aerodynamics associated with the flight of birds and insects have been elaborately described in this volume. There is a logical way in which the individual contributions are arranged and hence even for a researcher from a different area, understanding this book should not be a problem. I am particularly happy to see a small chapter on the laws on similarity in fluid mechanics. It appears that with the advances in computational capabilities as well as experimental flow diagnostics in fluid mechanics, the approach of using simple dimensional analysis and scaling laws to understand any problem appears to be no longer attractive to research students. I think, in this sense it was a good idea by the editor to have a dedicated chapter on dimensional analysis and a lucid description of the associated physical significance of the methodology.

It is only befitting to the contributions of Liebe, that a full chapter on finite vortex model and its applications to unsteady aerodynamics has been included in this book. I enjoyed reading the chapter on manifestation of finite vortex and the associated unsteady aerodynamic forces. The synergistic interplay between bird flight and vortex dynamics has been clearly brought out by the authors in this chapter. In fact, this is one of few books where the vortex shedding phenomenon in natural bird or insect flight has been exhaustively discussed and the pre-eminent role of vortex shedding in unsteady aerodynamics and propulsion has been clearly highlighted. A more rigorous mathematical phenomenological description could have been included, while describing the unsteady flow mechanisms on airfoils. Overall most of the articles in this volume arouse the curiosity of the reader and in some sense cajole him to go through the contents of the second volume, where many interesting applications are described.

The contents in Volume II will certainly be of interest to practising engineers. It is heartening to note that instead of taking a more flamboyant approach the authors have adopted a classical approach while describing state-of-the-art topics like micro-air vehicles. Many fundamental fluid dynamics problems such as unsteady boundary layer transition, smart wings and hovering aerodynamics have been discussed in this volume. The active researchers in the field will be happy to find elaborate descriptions on topics such as, use of ribblets for drag reduction, smart wings and unsteady characteristics of flow at low Reynolds number. What is really heartening to note is the conscious effort made by authors to highlight wherever possible, the existing inspirational designs in nature and how practising engineers can learn from nature. The description of shark skin and evolution of ribblets for drag reduction in aircrafts is one classic example of how one can learn from nature and implement the same in modern technology.

Detailed descriptions of both numerical and experimental research in the area of bird flight, hover aerodynamics and flapping wing aerodynamics have been included in this volume. The technical content is good and will be certainly useful to active researchers and students. If you are looking for the current state-of-the-art in numerical methods/techniques used to understand the intricacies of unsteady aerodynamics, then you should read this book. What impressed me most was the effort by the authors to marry basic physics with mathematics. In fact, the chapter on the indicial – Polhamus aerodynamics model for insect-like flapping during hover is well written. I enjoyed reading about some of the unusual hydrodynamic flow features of dolphin skin. I was thrilled to see the experimental visualization of vibrations of human larynx using high-speed video stroboscope. The description of painstaking experimental efforts at DLR Germany to build a small wind tunnel and fix a living grasshopper using a drop of colophony to the metal holder in the tunnel and measure the aerodynamic forces as well capture its flight using video stroboscope was captivating. I only wish that all of us as researchers have the same drive to venture into unknown territories just to quench our intellectual thirst! Going through the book made me ponder over the tremendous impact of biological sciences on various technological developments in the 21st century and the ever-shrinking border lines between various disciplines of science and engineering. Since both fundamental concepts, as well as state-of-the-art research have been carefully amalgamated in these two volumes, I strongly recommend this book for both undergraduate and graduate students as well as active researchers in the field.

G. JAGADEESH

Department of Aerospace Engineering,
Indian Institute of Science,
Bangalore 560 012, India
e-mail: jaggie@aero.iisc.ernet.in