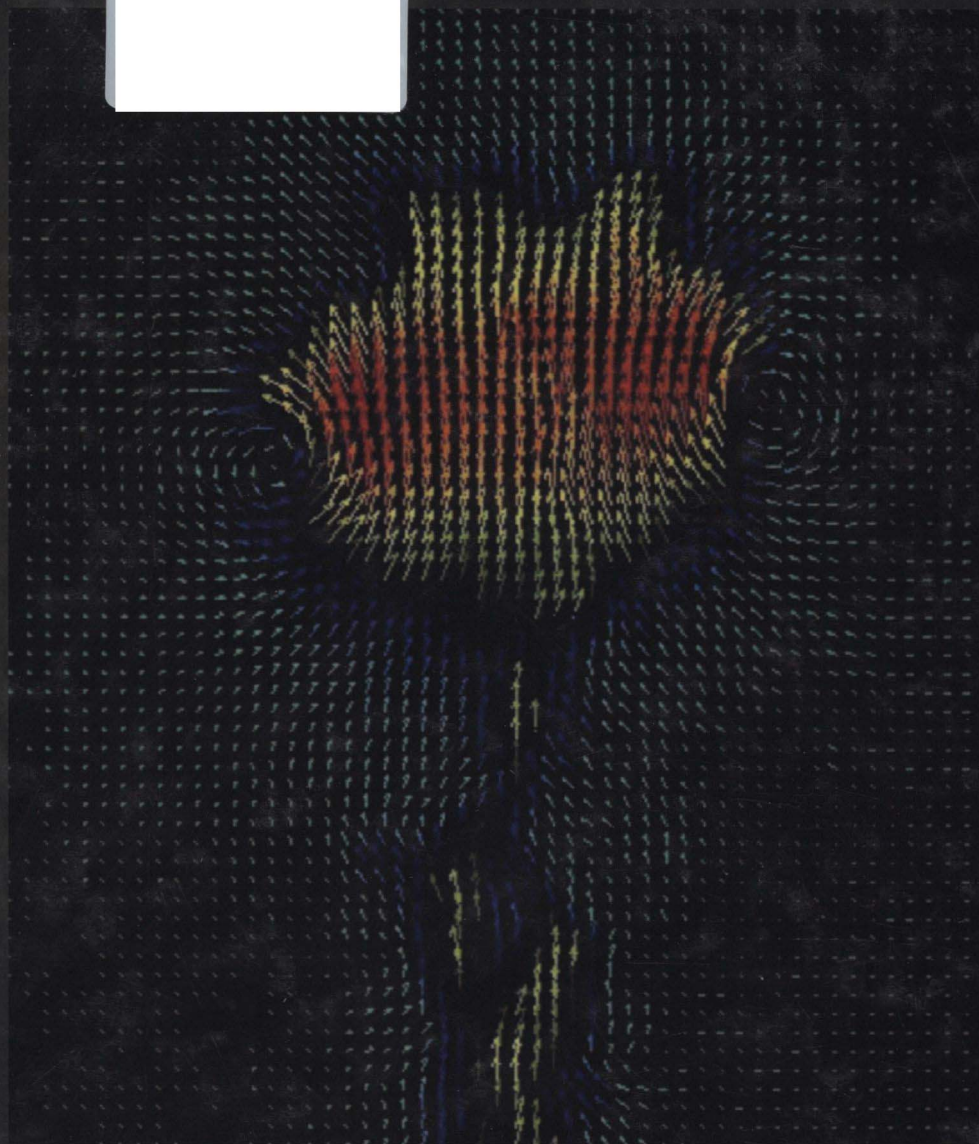


SYNTHETIC JETS

Fundamentals and Applications



Edited by
Kamran Mohseni
Rajat Mittal

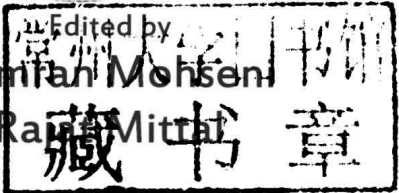


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SYNTHETIC JETS

.....to our families

Preface

Synthetic jets have been the subject of intense research and development for over two decades and have in this time been deployed in a wide variety of applications, ranging from separation and turbulence control to electronic cooling and propulsion. These jets are characterized by the fact that they are entirely synthesized from the surrounding fluid and introduce no net mass into the external flow. This fact eliminates the need for fluidic circuitry and enables self-contained, compact designs that integrate power and actuation and even control electronics. Although synthetic jets do not inject net mass, they do impart momentum, energy, and vorticity, and in doing so, effect local as well as global modifications in the external flow. The ability to prescribe and/or modify the jet frequency and amplitude as well as tailor the geometry of the jet opens up a vast parameter space that can be exploited in a diverse range of applications. This large operational space is, however, associated with a rich cornucopia of fluid dynamic mechanisms, and these mechanisms have to be understood well, in order to make effective use of these actuators in any given application.

Although the topic of synthetic jets may have matured to some degree, the scientific knowledge associated with these actuators remains scattered across hundreds of journal articles and conference papers. The objective of this book is to compile in one place fundamental as well as applied knowledge of these fluidic actuators. By providing a concise survey of the fundamental principles and analysis techniques, and a few selected applications, this book offers a treatment of the subject that should serve as a useful starting point for students, researchers, and technologists interested in this topic.

Kamran Mohseni
University of Florida

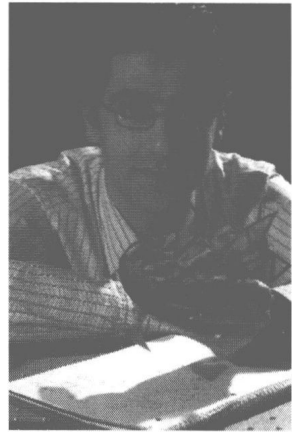
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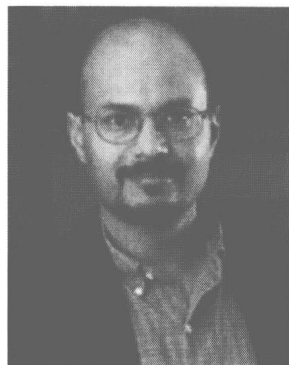
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Kamran Mohseni, who received his PhD in Mechanical Engineering from the California Institute of Technology in 2000, is professor and W.P. Bushnell endowed chair in the Department of Mechanical and Aerospace Engineering and in the Department of Electrical and Computer Engineering at the University of Florida in Gainesville. He is also the director of the Institute for Networked Autonomous Systems there. He was previously associate professor of Aerospace Engineering Sciences, University of Colorado at Boulder, as well as courtesy professor in the Departments of Electrical Engineering and Mechanical Engineering, and an affiliated faculty of the Department of Applied Mathematics. He was also a founding fellow of the Renewable and Sustainable Energy Institute (RASEI), a joint partnership with the National Renewable Energy Laboratory (NREL) in the Department of Energy. He earned his doctorate from the California Institute of Technology in Mechanical Engineering and his masters from Imperial College London in Aeronautics and Applied Mathematics. His research interests include bioinspired unmanned aerial and underwater vehicles, vehicle system dynamics and control, mobile sensor networking, and fluid dynamics. He is an associate fellow of the American Institute of Aeronautics and Astronautics and a member of other professional societies, including the American Physical Society, American Society of Mechanical Engineers, Society for Industrial and Applied Mathematics, Institute of Electrical and Electronics Engineers, and American Geophysical Union.



Rajat Mittal is professor in the department of mechanical engineering at the Johns Hopkins University in Baltimore, Maryland. He earned his PhD in applied mechanics from the University of Illinois at Urbana-Champaign and his masters in aerospace engineering from the University of Florida in Gainesville, Florida. He was a postdoctoral researcher in the Center for Turbulence Research at Stanford University before joining the University of Florida's department of mechanical engineering as an assistant professor. He was then appointed as faculty in the department of mechanical and aerospace engineering at The George Washington University in Washington, DC. His research focuses on computational fluid dynamics, low Reynolds number aerodynamics, biomedical flows, active flow control, biomimetics and bioinspired engineering, and fluid dynamics of locomotion. He is a fellow of the American Society of Mechanics Engineers as well as the American Physical Society, and an associate fellow of the American Institute of Aeronautics and Astronautics.



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