

Preface

Vortex rings and jets have always fascinated and captivated researchers and engineers alike, partly due to the surprisingly rich flow phenomena underpinning such seemingly simple flow scenarios, and partly due to their immediate relevance towards a significant number of industrial applications. Without going into the details, smoke rings exhaled from the mouth, squid propulsion, industrial waste issuing out of chimneys and exhaust from jet engines are just some of the immense numbers of real-world instances that illustrate the unique characteristics of vortex rings and jets. More interestingly, from the vortical structures and behaviour standpoint, vortex rings can often be treated, albeit simplistically, as the fundamental building blocks of more complex jet flows. From the extensive pool of experimental, numerical and theoretical studies conducted up to this point in time, both phenomena share many similarities in their underlying behaviour. In fact, many of the flow characteristics and vortex flow models postulated to better explain jet flow behaviour are based on or associated with vortex rings.

Despite their long history of being at the heart of many studies performed in the past, interest in vortex rings and jets has not waned. In reality, unique demands from both well-established and new emerging engineering applications, such as flow control, renewable energy and noise emissions, just to name a few, ensure that interest in them remains as high as before, if not greater. The main discernible difference between most present and past investigations is that the present focus is now on more complex flow configurations surrounding the use of vortex rings and jets, and how to better exploit them for useful purposes in an efficient and robust manner. And coupled with significant advances made in measurement and numerical tools such as particle image velocimetry, large-eddy simulation, and not to mention data analysis in the past two decades, more exacting details can now be extracted from the flow fields of vortex rings and jets for an unprecedented level of understanding.

In view of these new developments, it will be timely to provide some fresh updates to our collective understanding on vortex ring and jet flow phenomena through the present book, while not overwhelming the readers at the same time.

There have been many excellent seminal work in this area, including *The theory of turbulent jets* by G.N. Abramovich, *Turbulent jets* by N. Rajaratnam, *Vortex dynamics* by P.G. Saffman and *Fluid vortices: Fluid mechanics and its applications* edited by S.I. Green, just to name a selected few, and the authors hope the present contribution will provide new perspectives and inspirations to readers who desire to find out some of the latest studies in related areas. In particular, this book attempts to relate vortex rings with jets in a systematic manner through several key areas, namely free vortex rings, vortex ring-structure interactions, jets formed by vortex-ring trains, jets issuing from unconventional nozzles and jet-structure interactions. The editors believe that this book will serve the readers well, either as an update to some of the emerging knowledge on vortex rings and jets, or as a guide on how to tap some of their unique flow behaviour for new engineering applications. Lastly, the editors are especially thankful to all the authors for their contributions towards this book, without which this book would not have been possible.

Singapore
October 2014

Daniel T.H. New
Simon C.M. Yu

Vortex Rings and Jets

Recent Developments in Near-Field Dynamics

New, D.T.H.; Yu, S. (Eds.)

2015, IX, 235 p. 147 illus., 81 illus. in color., Hardcover

ISBN: 978-981-287-395-8