Preface

This volume contains the 2017 Annual Research Briefs that summarize the research activities at the Center for Turbulence Research (CTR) in its thirty-first year of operation. The primary objectives of CTR are the investigation and understanding of fundamental aspects of turbulent flows, and the development of physics-based models and predictive tools for multi-scale engineering analysis. The core philosophy that CTR uses to pursue these objectives is to bring together key individuals in research fields related to turbulent flows, and to provide them with a scientifically vibrant platform where they find encouragement to address diverse and challenging problems in turbulence.

Last year CTR hosted twenty-two resident Postdoctoral Fellows. The CTR roster for 2017 is provided in the Appendix. Also listed are the members of the CTR Steering Committee, which has met quarterly to act on fellowship applications.

The investigations reported in this volume have been supported by a number of different organizations. These include the Department of Energy's National Nuclear Security Administration (NNSA) through the Advanced Simulation and Computing (ASC) Program, along with the Air Force Office of Scientific Research (AFOSR), Office of Naval Research (ONR), and National Aeronautics and Space Administration (NASA).

The thirty reports contained in this volume are subdivided into six topical groups that cover a wide range of subjects related to multi-physics effects in turbulent flows. The first group of reports is focused on particle-laden turbulent flows, with particular emphasis on subgrid-scale modeling, uncertainty quantification, and experimental characterizations including radiative transfer, which are topics that occupy large attention at CTR as part of the Predictive Science Academic Alliance Program (PSAAP-II) at Stanford. The second group of reports is concerned with chemically reacting flows, including turbulent combustion and electrokinetics. The theme of the reports in the third group is two-phase flows, including applications to subgrid-scale modeling of micro-bubbles, hydrodynamic stability analyses of two-phase flows, and developments of numerical methods for the treatment of liquid-gas interfaces. Also included in this group are applications of high-pressure two-phase flows to transcritical mixing and heat transfer. Wall-bounded turbulence occupies the attention of the fourth group of reports, which emphasize on wall models for large-eddy simulations, hydrodynamic stability analyses of transitional flows, and experimental studies of high-speed turbulent boundary layers. The reports in the fifth group are focused on uncertainty quantification in turbulent flows. The last group of reports involves investigations of numerical methods with applications to flow-structure interactions, solid mechanics, and compressible flows.

It is a great pleasure to thank Pamela Nelson Foster and Vi Nguyen for their help on the day to day management of CTR. This volume is available online, including color versions of the figures in the reports, at the CTR website:
`http://ctr.stanford.edu`

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