Preface

This volume contains the 2014 annual research briefs that summarize the research activities at the Center for Turbulence Research (CTR) in its twenty-eighth year of operation. Earlier this year, CTR hosted seventy-five participants in the fifteenth biennial Summer Program, and a separate report documenting the main findings has been published.

The objective of CTR continues to be the fundamental understanding of turbulent flows along with the development of physics-based models and predictive tools for multi-scale engineering analysis. The investigations reported in this volume have been supported by a number of different organizations, including programs sponsored by the Department of Energy's National Nuclear Security Administration (NNSA), Air Force Office of Scientific Research (AFOSR), Office of Naval Research (ONR), National Aeronautics and Space Administration (NASA), National Science Foundation (NSF), as well as industrial partners and international research agencies.

There are 22 reports contained in this volume covering a wide range of topics related to multi-physics effects in turbulent flows. Particle-laden turbulent flow is the common theme of the first group of reports in this volume. Interest in this topic has been reinvigorated at Stanford as a result of the recently awarded Predictive Science Academic Alliance Program (PSAAP-II) by the Department of Energy's NNSA. The overarching problem of the PSAAP-II Center at Stanford involves full-scale computation, and uncertainty-quantification analysis of solar-power receivers based on distributed absorption of thermal radiation by small particles in the bulk of the turbulent co-flowing air. The reports in the second group focus on two-phase flows by addressing the dynamics of turbulent liquid-gas interfaces using high-fidelity computations. The development of numerical methods and diagnostics tools for flow data analysis is the topic of the third group of reports. The reports in the fourth group are dedicated to wall modeling in turbulent flows, which is a pacing item for large-eddy simulation, followed by a report on experimental diagnostics of NASA Common Research Model (CRM). The data from this experiment will be used for validation of the ongoing wall-modeled large-eddy simulation of CRM. A novel wall blocking strategy for RANS models is introduced next, followed by an LES-based analysis of a promising actuator for flow control applications. The combustion dynamics of gaseous and spray flames occupy the attention of the last group of reports in this volume.

Last year CTR hosted thirteen resident Postdoctoral Fellows, one Research Associate, one Visiting Researcher, and three Senior Research Fellows. The CTR roster for 2014 is provided in the Appendix. Also listed are the members of the CTR Steering Committee which has met quarterly to act on fellowship applications.

It is a great pleasure to thank Rika Bosmans and Vi Nguyen for their help on the day to day management of CTR, and Marlene Lomuljo-Bautista, and Hilda Gould for their assistance in the production of this volume. This volume is available online, including color versions of the figures in the reports, at the CTR website:
`http://ctr.stanford.edu/publications.html`

Parviz Moin
Javier Urzay