Preface

This volume contains the 2018 Annual Research Briefs that summarize the research activities at the Center for Turbulence Research (CTR) in its thirty-second 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 fourteen resident Postdoctoral Fellows. The CTR roster for 2018 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 twenty-three reports contained in this volume are subdivided into three topical groups that cover a wide range of subjects related to multi-physics effects in turbulent flows. The theme of the first group of reports is multi-phase turbulent flows, with particular emphasis on the air entrainment and generation of bubbles in breaking waves, the characterization of flow structures in bubbly flows, the development of numerical methods for compressible multi-phase flows, and the subgrid-scale modeling of particle-laden turbulence, the latter representing a topic that occupies 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 the dynamics of turbulent jets, including the quantification of structural uncertainties associated with subgrid-scale modeling, and the characterization of rare events of relevance for sound generation by turbulence. The theme of the reports in the third group is turbulence physics and modeling, including studies of the structures of near-wall eddies, the control and hydrodynamic stability of separated flows, the development of wall models over a wide interval of operating conditions ranging from subsonic to hypersonic flows and from low to high pressures, and the subgrid-scale modeling of turbulence in frameworks of high-order numerical methods.

It is a great pleasure to thank Pamela Nelson Foster and Vi Nguyen for their help on the day to day management of CTR, and to Curtis Hamman for his assistance with compiling the manuscripts featured in this volume.

This volume is available online, including color versions of the figures in the reports, at the CTR website:
`http://ctr.stanford.edu`

Parviz Moin
Javier Urzay