

Preface

This volume contains thirty-six 2025 Annual Research Briefs from the Center for Turbulence Research (CTR). CTR hosted twenty-two resident Postdoctoral Fellows, one Research Associate and two Senior Research Fellows in 2025. The CTR roster is provided in the Appendix, along with the membership of the CTR Steering Committee. This volume is available online at the CTR website: <http://ctr.stanford.edu>.

The activities at CTR this year span research into canonical turbulence investigations with implications for fundamental understanding and modeling in flows of interest to the naval research enterprise and beyond, specific multiphysics flow phenomena, engineering systems and outstanding computational, theoretical and experimental challenges.

The volume begins with theoretical and data-driven developments concerning the fundamental structure and effects of turbulence over walls, followed by experimental studies of turbulence at the edge of current sensor capabilities and/or full resolution for computational studies. The synergy between experiments and computation is further explored in terms of digital enhancement of physical diagnostics, before a series of briefs describing LES developments enabling investigation of complex multiphysics turbulent flows. Changes to boundary conditions and the numerical tools that enable their implementation in simulation are considered in the multiphase, geophysical and compressible flow realms. The volume closes with consideration of reacting flow physics and the potential for machine learning coupled with experimental observation and high performance computing to both advance understanding and enable efficient modeling.

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