

Preface

This report contains the 2007 annual technical reports of postdoctoral fellows and senior visitors of the Center for Turbulence Research. Recently, NASA's support for fundamental research in aeronautics expanded significantly under NASA's Aeronautics Research Mission Directorate Research Announcement, NRA. CTR has been able to compete successfully under this program, and as a result, several postdoctoral fellows were able to contribute to its sponsored projects. These projects are: prediction and modeling of jet noise and combustion noise, integrated simulation of realistic gas-turbine combustors, emissions in the supersonic regime, shock wave/turbulent boundary layer interaction and transition in the hypersonic regime. CTR expects to be heavily engaged in these research areas in the foreseeable future.

The first group of papers in this volume are in the area of hypersonic flows. This activity, including the related supersonic propulsion research, will be expanded in the future, and is planned to be a significant component of the CTR effort. The CTR work in this area will benefit from synergistic interaction with researchers in a new program on Predictive Science at Stanford, which has as its overarching problem, numerical simulation and physical modeling of an integrated hypersonic vehicle. This program is sponsored by the Department of Energy's Advanced Simulation and Computing program, which has provided sustained intellectual and financial support for computational science research at Stanford over the past decade.

The next group of papers are concerned with the development of numerical methods and integrated simulations. CTR's research in the area of uncertainty quantification, validation and verification of numerical solutions continues to expand, and is reported in the next group of papers. This is an area of emerging importance in computational science as increasingly complex multi-physics and interdisciplinary problems are tackled computationally. The next group of papers are concerned with fundamental developments in LES, including development of a new and more robust dynamic subgrid scale model for complex flows, and applications of LES in multi-physics areas such as combustion and noise. In collaboration with NASA Ames and Hansen Experimental Physics Laboratory at Stanford several CTR scholars have been studying solar convection and wave dynamics in the sun; they present their findings in the next group of papers. Several reports on fundamental studies of turbulent flows and flow control constitute the final collection of papers in this volume.

We are thankful to Dr. Donghyun You for his skillful editing and compilation of this report. Thanks are due to Ms. Sara Bedin for her day to day management of CTR. The CTR roster for 2007 is provided in the Appendix. This volume is available on the CTR site on the worldwide web (<http://www.stanford.edu/group/ctr/>).

Parviz Moin
Nagi N. Mansour