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Preface

The fourth Summer Program of the Center for Turbulence Research was held during the four-week period July 13 to August 7, 1992. As in the past summer programs, direct numerical simulation databases were used to study turbulence physics and modeling issues. Twenty-seven participants from seven countries were selected based on their research proposals. They joined twenty-three local participants from Stanford and NASA-Ames Research Center who devoted virtually all of their time during the Program to this activity.

The Program included a special emphasis on the physics of small scale turbulence which was, in part, motivated by the recent advances in subgrid scale modeling for large eddy simulations. A relatively large effort was also devoted to turbulent reacting flows. Direct numerical simulation of turbulent reacting flows has been an integral part of CTR's summer and core programs. A panel of experts (Thierry Poinsot, Stephen B. Pope, and Forman A. Williams) were invited to discuss application of these simulations (which due to computer limitations are performed with limited ranges of parameters) to turbulence combustion. A summary of the panel's deliberations was prepared by James Hill and is included in this report.

As part of the program, four review tutorials were given on *Vortical States, Vortex Filaments, and Turbulence* (Philip G. Saffman), *PDF Modeling* (Stephen B. Pope), *Energy Transfer Mechanism* (Shigeo Kida), and *Experimental Studies of Local Isotropy in high Reynolds Number Flows* (Seyed G. Saddoughi).

The databases consisted of a turbulent mixing layer, turbulent channel flow with passive scalar, forced homogeneous isotropic turbulence, compressible homogeneous turbulence, compressible free-shear flows, and reacting flows. Additional calculations were made when time series of the flow fields were needed. In particular, very large simulations of forced isotropic turbulence with 512^3 degrees of freedom were made on the massively parallel Intel/Delta computer at Caltech.

This report contains twenty-four papers that resulted from the 1992 Summer Program. The papers are divided into four groups and are preceded by an overview written by each group coordinator. Early reporting of some of the projects occurred at the Forty-Fifth Meeting of the Fluid Dynamics Division of the American Physical Society in Tallahassee, Florida, November 22-24, 1992. Fifteen abstracts based on the work accomplished during the Summer Program were presented at this meeting.

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