Project Report

**Conference on Analysis, Modeling and Computation
of PDE and Multiphase Flow**

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This grant has supported the Conference on Analysis, Modeling and Computation of PDE and Multiphase Flow, which was held on Aug. 3-5, 2004 at the Charles B. Wang Center on the campus of Stony Brook University. A total of 32 invited and contributed presentations were delivered at the Conference. Speakers at the Conference include senior scientists, postdocs and graduate students. Among the speakers are 7 woman scientists, and two speakers from abroad. The Conference brought researchers from universities (24) and national laboratories (8) with topics ranging from theoretical and numerical analysis of hyperbolic conservation law to the computation and modeling of multiphase flow.

More than 60 people including many graduate students from about 20 American universities and 5 national laboratories (LLNL, LANL, BNL, LBNL, SNL) participated the conference. Also among the participants are speakers from Brazilian Institute of Pure and Applied Mathematics and The Hebrew University of Isreal. During the Conference, senior scientists and young and active investigators exchanged their findings and discoveries in hyperbolic conservation law, numerical and computational results of compressible flow and multiphase modeling of turbulent mixing.

A Panel Discussion on 'The Future of Applied Mathematics' followed the Conference. This panel discussion was chaired by Professor James Glimm of the Stony Brook University. The panelists include Blake Temple (UC Davis), Guiqiang Chen (Northwestern University), Tai-Ping Liu (Stanford), Alexander Chorin (UC Berkeley) and Phillip Collela (LBNL). The discussion commenced with each panelist presenting a brief statement on his views about the future of the applied mathematics field. This was followed by a lively discourse among the panelists and between audience members and panelists on issues raised by the panelists and on other issues related to the future of applied mathematics.

In his opening statement, Blake Temple outlined what he believed to be the two basic issues facing the field of conservation laws: the structure of solutions and the stability of solutions. And while acknowledging that great advances had been made in the study of conservation laws, he underlined the view that the mathematical theory underpinning the field was still in its infancy and much theoretical work remained to be done. Gui-Quiang Chen listed solving the three-dimensional Navier-Stokes equations and a deeper study of multi-dimensional hyperbolic problems as two of the major issues he saw facing applied mathematics in the future. He particularly mentioned the importance of understanding the relation between shock waves and vor-

ticity. Phillip Colella envisioned the role of (both theoretically and computationally) well-trained mathematicians as crucial to the future advancement of science. Interestingly, he saw more sophisticated software design and development as a field for which mathematicians were especially well-prepared, even more so than computer scientists. In his view, the increasingly complex requirements of scientific computing would put mathematicians in the foreground of software design and development, since they were better able than computer scientists or physicists to marry the complex scenarios of science with the abstract thought process required to develop good, effective software tools to solve those scientific problems.

The panel Chair, James Glimm, then redirected the debate to the issue of achieving a balance between theory, computation, and modeling in producing future applied mathematics scientists. He reiterated the generally stated belief that there was currently too much focus on applications and computing at the expense of theory in the education of applied mathematicians. He openly wondered whether he would be attracted to the field of (applied) mathematics today with its focus on applications; the theory and ideas which stirred him are no longer in the foreground of the field.

The panel discussion then concluded. The main theme running throughout much of the discussion was the importance of preserving and promoting a strong theoretical foundation in mathematics as a first step in ensuring that the future generation of applied mathematicians are suitably equipped to continue the advances made by the likes of James Glimm and his fellow panelists.

Total of 28 short papers have been collected from the speakers. We intend to publish them as either a book or an electronic book.