THE ROLE OF COMPUTATIONAL FLUID DYNAMICS IN MODERN SCIENTIFIC DISCOVERY

Dr. David L. Brown
Lawrence Livermore National Laboratory

Modern scientific discovery increasingly relies on large-scale scientific computing to provide prediction and understanding of physical processes that are not accessible to experiment or observation. A large category of such problems, including the study of stellar evolution, weather prediction, climate modeling, weapons design, and aeronautical design, depend on the numerical solution of the equations of fluid dynamics. "Computational fluid dynamics" has developed and grown as a discipline over the past half-century and is a part of many major research programs in academics, industry, and at the U.S. federal laboratories.

This talk will focus on the types of scientific questions that have been asked and which can be answered by applying the techniques of computational fluid dynamics. It will also look at the role that applied and computational mathematics has played in developing solution techniques and finding answers to these questions. Particular examples will be given showing the types of mathematical analysis that can and have been used to develop effective computational approaches for solving these problems. This talk will also touch briefly on the role of ÒexperimentalÓ computation in helping to answer important scientific questions.