SIMULATION OF COMPLEX PROBLEMS: PROMISES & PITFALLS

Akshai K. Runchal
Analytic & Computational Research, Inc.
1931 Stradella Road, Bel Air California
runchal@ACRiCFD.com www.ACRiCFD.com

ABSTRACT This talk explores the relationship between "Real" systems and their representation by "Numerical" models such as those in CFD. In the process a number of crucial steps need to be carried out. The "Real" system is first represented by a "Thermodynamic" system which in turn is expressed in terms of a "Mathematical" system. Finally the Mathematical model is solved by "Numerical" methods. Each of these steps involves explicit and implicit assumptions about the behavior of the system. Each of these systems suffers from problems related to "representability". For example, a non-linear mathematical system (with multiple modes or solutions) is often represented by quasi-linear or linearized numerical model (with possibly fewer modes or solutions). Often a continuum physical domain is represented by a discontinuous discrete domain.

This talk explores the relations between the "Real", "Thermodynamic", "Mathematical" and "Numerical" systems. It discusses the common pitfalls in the process of computational simulation and explores the ways to minimize their impact. The talk will also highlight the great and significant role that computational simulation has played in obtaining or suggesting solutions to some of the most intractable problems in physics of fluids.