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Teaching Scientific Computing with N-Body Simulations

Vicki Johnson

Interconnect Technologies Corporation, Claremont, CA

Peter Teuben

Astronomy Department, University of Maryland, College Park, MD

Abstract. The classic N-body problem can be used to teach many dimensions of scientific computing. The BoF participants were invited to discuss approaches and motivations.

1. Birds-of-a-Feather Discussion Topics

Many undergraduate students are not learning how to program, how to use Unix, or the basic principles of scientific computing and numerical estimation. The classic N-body problem can be used to illustrate many dimensions of scientific computing, The BoF participants were invited to discuss how to use the classic N-body problem to introduce students to modeling, algorithms, the development of simple programs to implement basic algorithms, the Unix environment and open source tools, tradeoffs between efficiency and accuracy, numerical analysis, visualization and animation, scalability, and supercomputing (e.g., GRAPE cards) and parallel programming, and interdisciplinary uses of N-body simulations, such as in computational biology and astrophysics.

The group generally agreed that the N-body problem is a good teaching tool. As you progress with the N-body problem, opportunities to teach yourself naturally arise—how to improve accuracy, deal with long run times and lots of output, visualizing the results, etc. The consensus was that the N-body problem lends itself well to a simple Java implementation, which would be a good starting point for young students. An appealing approach is to make the motions in N-body simulations fun to play with, by tweaking parameters for spin, rotation and scaling. Above the level of equations, give students a game-like feel for motions that could be almost a tactile experience. Wolfram's work shows both complexity and fun can arise from simple examples. For more information, see `http://www.nbodylab.com/adass2002-bof.html`.