

Results from Prior NSF Support

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NSF award number: ASC-9523481 Dates: 11/1/95–10/31/99 Amount: \$927,935 (total costs for three years, plus current no-cost extension; not including two supplements discussed below); “Integration of Information Age Networking and Parallel Supercomputing Simulations into University General Science and K–12 Curricula”

This Metacenter Regional Alliances grant is concerned with developing Web-based educational modules based on four supercomputing simulations projects: a) membrane fluctuations, b) fluid dynamics, c) crackling noise and associated hysteresis, and d) crack propagation in societal structures, such as dams. The former two projects are conducted at Syracuse University, respectively in the physics department and in aeronautics. The latter two take place at Cornell under a subcontract. Because of space limitations, this report will focus on the physics department activity. Additional information on all four modules is available via our grant project Web site (www.sims-science.org). We have created Java applet versions of both our fluid- and crystalline-membrane simulations (which arise from representations of "string" theories in particle physics and cosmology). We have also written several other Java applets to illustrate other ideas in physics and principles behind the main simulations. For example, we have written an applet that simulates a simple spring—how the force and stored energy change with extension—to illustrate how the springs used in our crystalline membrane applet work. In addition to Java applets and digital video we have used virtual reality modeling language (VRML) to visualize the output of off-line membrane simulations. We are using examples from everyday life and biology in particular to motivate explanation of the concepts underlying membrane physics. We have also demonstrated collaborative versions of some applets using NPAC's innovative Tango collaborative system (www.npac.syr.edu/tango/). The project is carried out with the participation of one postdoctoral research associate at Syracuse and several graduate and undergraduate (REU) students at both institutions. We were awarded a \$25,000 REU supplement in the summer of 1997. In addition, we have been awarded a \$350,000 supplement for integration of this project with vBNS/Internet II.

Publications

- Catterall, S., Goldberg, M., Lipson, E., Middleton, A., and Vidali, G. Implementation of information technologies in the teaching of “Science for the 21st Century” *Int. J. Mod. Phys. C* 8:49-66, 1997.
- Warner, S., Catterall, S., and Lipson E.D. Java simulations for physics education. *Concurrency: Practice and Experience*, 9:477-484, 1997.