Awards Recognize Excellence and Innovation in CSE Education

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As part of a strategy to strengthen computational science education, the US Department of Energy sponsors awards to recognize excellence and innovation in CSE teaching at the undergraduate level. These programs are sponsored through the Office of Scientific Computing and administered through the Applied Mathematical Sciences Division of Ames Laboratory, located at Iowa State University. This particular CSE effort is part of the DoE's broader Undergraduate Computational Engineering and Science (UCES) project, detailed in the Fall '95 issue of *IEEE CS&E* (pp. 69–73). The Undergraduate Computational Science Awards (UGCSA) contribute to CSE by encouraging curricular innovation through the direct incentives of professional recognition and cash awards; building a network of professionals committed to improving CSE; increasing public awareness of the importance of CSE; promoting the use of computer-based problem-solving activities in science and engineering, especially computational modeling and assessment; and facilitating the sharing of CSE instructional materials through electronic archives.

The paradigm evolved from exactly the kind of collaborative work that UGCSA encourages.

1994 winners

To accomplish these objectives, the UGCSA program issued a national call in 1994 for outstanding undergraduate-level CSE projects. While the nominated projects ranged across many disciplines, most fell into three categories:

(1) individual instructional modules focusing on a particular problem, concept, or model;
(2) a curricular innovation involving a single course or a set of interrelated courses; and
(3) computational tools to support instructional development.

Winners received $1,000 and travel to Washington, D.C., for an awards exposition and dinner, an opportunity both to be recognized for their achievements and to share their projects with other educators and with professionals from government and industry. The winners were as follows:

- Michael C. Ferris and O.L. Mangasarian, Computer Sciences Dept., University of Wisconsin at Madison: an instructional module on breast cancer diagnosis via linear programming (see *CS&E*, Fall '95, pp. 70–71)
- Steven Homer and Roscoe Giles, Center for Computational Science, Boston University: a course on methods and scientific applications of parallel computing
- Orlando E. Katter Jr., Computer Information Systems Dept., Wingate College: a project on the scientific modeling of body motion
- Thomas LoFaro, Kevin Cooper, and Ray Huffaker, Pure and Applied Mathematics, Washington State University: computer exercises illustrating the use of differential equations in environmental and life sciences
- Tom R. Lucas, Mathematics Dept., University of North Carolina at Charlotte: modeling and numerical simulation of single-stage-to-orbit rockets
- Robert Panoff and Ben Davenport, National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign: GalaxSee, a visual computing environment for studying the *n*-body problem
- Robert Panoff, Amy Biermann, and Ben Davenport, NCSA, UIUC: RealSim Surface, a computational science approach to optimization

(see p. 6 for more details)

- Ronald D. Poshusta, Chemistry Dept., Washington State University: lecture demonstration models on computer tools for problem solving in physical chemistry
- Clifford A. Shaffer and Edward A. Fox, Dept. of Computer Science, and Laurence W. Carstensen Jr. and Robert W. Morrill, Dept. of Geography, Virginia Polytechnic Institute and State University: a GIS-based simulation laboratory for introductory geography education
- D.E. Stevenson, Dept. of Computer Science, Clemson University: a project on using computational science simulations in population biology studies
- Kris Stewart, Dept. of Mathematical Sciences, San Diego State University: CSE curriculum development on supercomputing
- Carol Tretkoff and Ken McAloon, Dept. of Computer and Information Science, and Yehuda Klein, Dept. of Economics, Brooklyn College of the City University of New York: a course in computational logic and decision science integrating economic and management science models with computer science methods
- Steve Williams, Chemistry Dept., Appalachian State University: a computational experiment on adiabatic flame temperature

Later in 1994, UCES conducted a pilot project to recognize excellence in World Wide Web-based educational efforts by students. Two universities, Mississippi State University and the Colorado School of Mines, were selected as institutional participants. UCES hopes eventually to expand this into a national student awards program. The winners included

- Tim Miller, Mississippi State: the projectile motion of a nonstationary target (introductory level)
- Edward Harden, Mississippi State: the flat plate as supersonic airfoil (sophomore level)
- Charles Farris, Colorado School of Mines: ship hull hydrostatics (junior level)

- Richard Relue, Colorado School of Mines: parallel processing implementation of wavelet transform (senior level)
- Andrew Hustrulid, Colorado School of Mines: parallel implementation of the discrete-element method (senior level)

Students awarded honorable mention were

- Timo Tjan, Colorado School of Mines: finite-difference modeling of seismic wavefields in complex velocity
- Tong Chen, Colorado School of Mines: parallel seismic phase-shift migration

1995 winners

This year UGCSA sponsored a second round of professional awards. Although the basic program remained unchanged, much had transpired in the CSE community and in the UCES organization this year. First, a number of the nominated projects followed the five-element structure developed by UCES as a guideline for CSE instructional materials. This problem-model-method-implementation-assessment paradigm had evolved from exactly the kind of collaborative work that the first UGCSA program sought to encourage. Second, a greater percentage of project materials were submitted electronically, which made it easier to share them with other teachers. Noticeable, too, was the increase in curricular projects with an interdisciplinary design.

This year's winners were as follows:

- Paul Abbott, Dept. of Physics, University of Western Australia, Nedlands: an electronic course in computational physics built around interactive, laboratory-style experiments
- Charles W. Fletcher, Dept. of Mathematics, University of Maryland–University College and Techno-Sciences, Inc.: a software tool for building interactive mathematics lessons on the World Wide Web
- Holly Peters Hurst, Dept. of Mathematical Sciences, Appalachian State University: a series of instructional modules for using population modeling to teach mathematics and computational science
- Elizabeth R. Jessup, Lloyd D. Fosdick, and Carolyn J.C. Schauble, Dept. of Computer Science, University of Colorado at Boulder, and Gitta O. Domik, Dept. of Computer Science, University of Paderborn, Germany: two-semester course sequence in high-performance computing where students match computer architectures to real problems and use color, perspective, and animation to interpret supercomputer data
- Hannes Jonsson, Dept. of Chemistry, University of Washington: a computer lab course for juniors and seniors in chemistry and biochemistry as an introduction to research-level computing and software
- Rubin Landau, Dept. of Physics, Oregon State University: a course in computational physics featuring creative problem solving, visualization, and sonification strategies, and attention to the limits of computational tools
- John J. O'Connor and Edmund F. Robertson, School of Mathematical and Computational Sciences, University of St. Andrews, Scotland: a computational science project for students in the life sciences
- Robert Panoff, Michael South, and Ben Davenport, Shodor Education Foundation: an interactive computational science lesson based on Edgar Allan Poe's short story "The Pit and the Pendulum," in which students use conjecture, inquiry, and experimentation to understand the period of a pendulum
- Jean M. Standard, Dept. of Chemistry, and Hiroshi Matsuoka, Dept. of Physics, Illinois State University: a multidisciplinary course in computational science as part of a larger CSE curriculum development
- Dawn Tilbury, Dept. of Mechanical Engineering and Applied Mechanics, University of Michigan: a series of tutorials for teaching control systems design to engineering students
- Robert E. White, Dept. of Mathematics, North Carolina State University: a course in computational mathematics emphasizing numerical modeling

Awarded honorable mention were Ignatios Vakalis, Dept. of Mathematics and Computer Science of Capital University, for an interactive lesson on the problem of calculating electrostatic potential; and Sarah Inkpen, School of Aviation and Flight Technology, Ontario, Canada, for a project using virtual reality and other visual experiences to teach college-level calculus.

In 1995 UCES also inaugurated a new Leadership in Computational Science Award, which was presented to Roscoe Giles, Center for Computational Science at Boston University. Among Giles's notable contributions to CSE education has been curricular development in parallel computing for students in the natural sciences, engineering, and computer science.

The schedule for the 1996 awards has yet to be finalized. Readers interested in participating are encouraged to register by e-mail (send a message to ugcsa@uep.ameslab.gov) and details of the 1996 competition will be provided as they become available. Also, a number of the projects and teaching modules mentioned above are available free of charge via the Internet. ◆

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remote high-performance computing with an appropriate Web browser, we can bring these authentic, active learning environments to the widest educational audience. Students are actually engaged in the process of science and mathematics, and not just reading about it from a book or watching someone else perform a demonstration. ◆

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