Scientific Computing

Interdisciplinary

The Scientific Computing Concentration is an interdisciplinary program in the application of computers to scientific work. A longer title for the program might be "Computing within a Scientific Context."

The concentration focuses on four major areas: (1) computer program development, including the construction and implementation of data structures and algorithms; (2) mathematical modeling of natural phenomena (including cognitive processes) using quantitative or symbolic computer techniques; (3) analysis and visualization of complex data sets, functions, and other relationships using the computer; and (4) computer hardware issues, including the integration of computers with other laboratory apparatus for data acquisition. The overall aim is to prepare the student to use computers in a variety of ways for scientific exploration and discovery.

Faculty

Benjamin W. Schumacher, Director, Professor of Physics
Nuh Aydin, Associate Professor of Mathematics
Scott D. Cummings, Associate Professor of Chemistry
Bradley A. Hartlaub, Professor of Mathematics
Sheryl A. Hemkin, Associate Professor of Chemistry
John E. Hofferberth, Harvey F. Lodish Faculty Development Professor and Assistant Professor of Chemistry
Robert S. Milnikel Jr., Associate Professor of Mathematics
Andrew J. Niemiec, Associate Professor of Psychology
Timothy S. Sullivan, Professor of Physics
Paula C. Turner, Associate Provost; Associate Professor of Physics

Curriculum and Requirements

The concentration in scientific computing requires a total of 3 units of Kenyon coursework. MATH 118 Introduction to Computer Science (.5 unit) serves as a foundation course for the program, introducing students to programming and other essential ideas of computer science.

Since computational methods are of increasing importance in every scientific discipline, students in the scientific computing program will take at least 1 unit of "contributory" courses in one or more scientific disciplines. Contributory courses have been identified in chemistry, economics, mathematics, and physics (see list below). In these courses, computational methods form an essential means for attacking scientific problems of various kinds.

Students in the concentration will also take at least 1 unit of "intermediate" scientific computing courses. These courses have computational methods as their main focus and develop these methods extensively.

In addition to regular courses that are identified as "contributory" or "intermediate," particular special-topics courses or independent studies in various departments may qualify in one of these two categories. Students who wish to credit such a course toward the concentration in scientific computing should contact the program director at the earliest possible date.

The capstone course of the program is SCMP 401 Advanced Scientific Computing (.5 unit), a project-oriented, seminar-style course for advanced students.

Required courses (1 unit)
MATH 118 Introduction to Programming
SCMP 401 Advanced Scientific Computing

Contributory courses (1 unit)
CHEM 336 Quantum Chemistry
ECON 375 Introduction to Econometrics
MATH 206 Data Analysis
MATH 226 Design and Analysis of Experiments
MATH 347 Mathematical Models
PHYS 140,141 Classical Physics
PHYS 240,241 Fields and Spacetime
PHYS 380, 381, 382 Electronics
PHYS 385, 386, 387 Experimental Physics

Intermediate courses (1 unit)
MATH 218 Data Structures and Program Design
MATH 237 Numerical Analysis
MATH 328 Coding Theory and Cryptography
PHYS 218 Dynamical Systems and Scientific Computing
PHYS 219 Complex Systems in Scientific Computing
SCMP 493 Individual Study in Scientific Computing

Scientific Computing Course

SCMP 401 Scientific Computing Seminar

Credit: .5 unit **QR**

This capstone course is intended to provide an in-depth experience in computational approaches to science. Students will work on individual computational projects in various scientific disciplines. This year the course will focus on applications of parallel computing using Kenyon's Beowulf-class computing cluster and other resources at the Ohio Supercomputer Center. Prerequisites: MATH 118, junior or senior standing, and permission of the instructor and the program director.

Additional courses that meet the requirements for this concentration:

CHEM 336: Quantum Chemistry
ECON 375: Introduction to Econometrics
MATH 118: Introduction to Programming
MATH 206: Data Analysis
MATH 218: Data Structures and Program Design
MATH 226: Design and Analysis of Experiments
MATH 347: Mathematical Models
PHYS 140: Classical Physics
PHYS 141: Introduction to Experimental Physics I
PHYS 218: Dynamical Systems in Scientific Computing
PHYS 219: Complex Systems in Scientific Computing
PHYS 240: Fields and Spacetime
PHYS 241: Fields and Spacetime Lab
PHYS 380: Electrical Measurement and Electronics
PHYS 381: Advanced Experiments in Analog Electronics
PHYS 382: Advanced Experiments in Digital Electronics
PHYS 385: Introduction to Advanced Experimental Physics
PHYS 386: Advanced Experiments in Nuclear Physics and Optics
PHYS 387: Advanced Experiments in Condensed Matter Physics and Magnetic Resonance Effects
PHYS 493: Individual Study
SCMP 401: Scientific Computing Seminar