
Computational Science

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In the College of Sciences

Associated Faculty for Computational Science

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Joseph Katz, D.Sc., Professor of Aerospace Engineering and Engineering Mechanics
Joseph M. Mahaffy, Ph.D., Professor of Mathematics
Patrick J. Papin, Ph.D., Professor and Department Chair of Physics
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Robert S. Pozos, Ph.D., Professor of Biology
Peter Salamon, Ph.D., Professor of Mathematics
Anca Mara Segall, Ph.D., Professor of Biology
Donald R. Short, Jr., Ph.D., Professor of Mathematical and Computer Sciences, Emeritus
Kris Stewart, Ph.D., Professor of Computer Science
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Andrew L. Cooksy, Ph.D., Associate Professor of Chemistry
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Eugene A. Olevsky, Ph.D., Associate Professor of Mechanical Engineering
Kim Bak Olsen, Ph.D., Associate Professor of Geological Sciences
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Arlette R.C. Baljon, Ph.D., Assistant Professor of Physics
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Scott Kelley, Ph.D., Assistant Professor of Biology
Richard Levine, Ph.D., Assistant Professor of Statistics
John J. Love, Ph.D., Assistant Professor of Chemistry
Antonio Palacios, Ph.D., Assistant Professor of Mathematics
Marie A. Roch, Ph.D., Assistant Professor of Computer Science
Forest Rohwer, Ph.D., Assistant Professor of Biology
Eric L. Sandquist, Ph.D., Assistant Professor of Astronomy
Roxana N. Smarandache, Ph.D., Assistant Professor of Mathematics
Satchi Venkataraman, Ph.D., Assistant Professor of Aerospace Engineering and Engineering Mechanics
Fridolin Weber, Ph.D., Assistant Professor of Physics

Section I. Master's Degree Program

General Information

The computational science program offers a Master of Science degree. It is offered in collaboration with the Departments of Biology, Chemistry, Computer Science, Geological Sciences, Mathematics and Statistics, and Physics, in the College of Sciences.

Graduates of this program will have a solid foundation in a field of science and the additional training and experience required of computational science professionals. Fundamental science, in one of the specializations, dominates the program. This is supplemented with additional courses in computational science. Real scientific problem-solving is emphasized, through a thesis that could be done in conjunction with a carefully managed extramural research program. A significant proportion of the students in this program will be employed in positions related to their area of studies, thereby providing opportunities for extramural support. Graduates will be prepared for positions in scientific research, scientific programming, and software engineering.

Associateships

Graduate teaching associateships and graduate nonteaching associateships may be available from the individual departments. See the appropriate department of this bulletin for more information.

Admission to Graduate Study

All students must satisfy the general requirements for admission to the University with classified graduate standing, as described in Part Two of this bulletin. If the undergraduate preparation of the students in the desired specialization is deficient, they will be required to take courses for the removal of the deficiency. These courses, taken by students as a classified graduate student, are in addition to the minimum 30 units required for the master's degree. A complete student program must be approved by the computational science program director. The requirements for entering this program consist of one year of computer programming (e.g., C or Fortran), competence in linear algebra and calculus, and a background equivalent to a bachelor's degree in the area of interest.

In addition to submitting an application to the University, students interested in this program are required to 1) Arrange for three letters of recommendation to be sent to the Computational Science Program Director; 2) Submit to the Computational Science Program Director a personal statement, motivating their interest for the program and briefly describing their research interests and educational goals; 3) Two official transcripts (in sealed envelopes); and 4) GRE scores.

Advancement to Candidacy

All students must satisfy the general requirements for advancement to candidacy as described in Part Two of this bulletin.

Specific Requirements for the Master of Science Degree

(Major Code: 07992)

In addition to meeting the requirements for classified graduate standing, the student must satisfy the basic requirements for the master's degree as described in Part Two of this bulletin. The student must also complete a graduate program of 30 units, of which at least 15 units must be in 600- and 700-level courses excluding 797, 798, and 799A to include:

1. Twelve units selected from:
 - Computer Science 503. Scientific Database Techniques (3)
 - Computer Science 505. Parallel Computing (3)
 - Computer Science 689. Scientific Visualization (3)
 - Mathematics 636. Mathematical Modeling (3)
 - Mathematics 693A. Advanced Numerical Analysis (3)
 - Mathematics 693B. Advanced Numerical Analysis (3)
2. Six units of approved 500-, 600-, or 700-level courses in disciplines related to the student's specialization.
3. Six units of approved 500-, 600-, or 700-level electives.
4. Six units of research including Thesis, 797 and 799.

A complete student program must be approved by the computational science program director. The requirements for entering this program consists of one year of computer programming in a programming language such as C or Fortran, competence in linear algebra and calculus, with background equivalent to a bachelor's degree in the area of interest.

Section II. Doctoral Program

<http://www.sci.sdsu.edu/compsci/phd>

General Information

San Diego State University and Claremont Graduate University, offer jointly a doctoral program in computational science. The cooperating faculties are from the Colleges of Engineering and Sciences at San Diego State University and participating units from Claremont Graduate University.

Admission to Doctoral Study

In order to be considered for admission into the program, applicants must fulfill the general requirements for admission with graduate standing to both institutions. Applicants must meet special requirements of this program which include (a) a baccalaureate degree from an accredited institution in a scientific discipline or engineering. Applications from outstanding candidates with degrees in other areas may be accepted conditionally; normally, these students will be expected to take during their first year of enrollment the necessary coursework to eliminate deficiencies; (b) an undergraduate minimum grade point average of 3.0 and minimum 3.50 in any previous graduate coursework; (c) suitable scores on both the quantitative and verbal sections of the Graduate Record Examination.

Application: A complete application requires the following:

- Appropriate application form.
- Transcripts of all post-secondary coursework.
- Results of the Graduate Record Examination.
- Applicant's statement of purpose, explaining their interest in the program.
- Three letters of recommendation from former or current professors, supervisors, or other appropriate persons.

Faculty Advisers and Doctoral Committee: Upon admission to the program, the student will be assigned a faculty mentor from either institution. After completing the first year of study and receiving a progress evaluation, the student will select a doctoral adviser. The doctoral adviser will aid in the development of a suitable course of study for the student, administer the student's qualifying examination, monitor progress of student research and administer the defense of the doctoral dissertation.

Specific Requirements for the Doctor of Philosophy Degree

The program consists of a minimum of 72 units of coursework, independent study, and research (including transfer credit) distributed as follows:

Minimum 24 units of graduate level coursework at SDSU (computational science program);

Minimum 24 units of graduate level coursework at CGU (graduate mathematics program);

Minimum 24 units of research, practicum, dissertation, and graduate seminar at either institution.

24 to 48 additional units of research, practicum, dissertation, and graduate seminar (COMP 800) may be taken at either institution. A student entering the program with a Bachelor of Science degree will satisfy the initial 24 unit requirement by completing a Master of Science degree in computational science at SDSU, then take 24 units of coursework at CGU. Students with an advanced degree other than computational science will complete appropriate courses and a research project to obtain the equivalent of an M.S. degree in computational science.

Claremont Graduate University Courses: Students are required to take 24 units at Claremont Graduate University. There is a core course requirement that must be satisfied with students selecting at least one course each from three of the following four categories:

Category 1: Mathematics 389, Discrete Modeling.

Category 2: Advanced Statistics with Computation: Examples of courses that would fulfill this requirement include Mathematics 351, Time Series; Mathematics 352, Nonparametric Statistics with Resampling Methods; Mathematics 353, Advanced Topics in Statistics Inference; Mathematics 355, Linear Statistical Models.

Category 3: Mathematics 368, Advanced Numerical Analysis or Mathematics 362, Numerical PDEs.

Category 4: Exotic Algorithms: Mathematics 469, Artificial Neural Networks; Mathematics 359 or 369, Monte Carlo Methods.

The additional units taken to make up the 24 unit requirement at Claremont Graduate University are electives to be selected with approval of the faculty adviser at SDSU and CGU. For example, students interested in computational problems in finance may elect to take Mathematics 358, Mathematical Finance, or other related electives. Students whose computational interests lie in signal processing and encryption may take Mathematics 335, Integral Transforms; Mathematics 374, Encoding and Encryption; and/or Mathematics 350, Kalman Filtering. The student's program of study beyond the core requirement will be tailored to the student's individual research interests.

Research Units at SDSU: Computational Science 797, 800, 810, 890, 895, 896, 897, 898, 899.

Qualifying Examination. The qualifying examination shall consist of a term research project supervised by a faculty mentor. The topic of the project will be approved by the program directors in consultation with the faculty mentor. The student will be required to prepare a written account of the research work performed and of its results, and offer an oral presentation before the members of the advisory committee. This level of evaluation will be equivalent and coincide with the computational science Master of Science degree final examination.

Practicum and Doctoral Research. Dissertation research will be carried out here at one of the two institutions, at an industry, or at a national laboratory. In the latter two cases, its denomination is practicum.

Dissertation Proposal. The dissertation proposal shall be submitted by the student to the advisory committee no later than upon completion of the student's third academic year in the program. The dissertation proposal will take the form of a scientific grant proposal to a major funding agency. The proposal will describe the research project that the student intends to carry out, on which the doctoral dissertation will be based. The student will also be required to deliver an oral presentation before the computational science faculty. Upon successful completion of the presentation, the student will be recommended for advancement to candidacy for the doctoral degree.

Doctoral Dissertation. Upon completion of the dissertation research, the candidate will submit the dissertation to the advisory committee. The candidate will also present a public oral defense of the dissertation. Before the presentation, an account of the work performed will be submitted for publication to a peer-reviewed, international research journal. Upon successful completion of the presentation, the candidate's advisory committee will make a recommendation to the Graduate Deans.

Faculty

The following faculty members of the cooperating institutions participate in the joint doctoral program and are available for direction of research and as members of joint doctoral committees.

San Diego State University

Program Director: José E. Castillo

Committee Members: Baljon, Bhattacharjee, Carretero, Castillo, Cooksy, Day, Deutschman, Frey, Greferath, Impelluso, Johnson, Kelley, Kelly, Love, Mahaffy, Mellors, Olevsky, O'Sullivan, Palacios, Paolini, Pullman, Roch, Rohwer, Salamon, Sandquist, Segall, Smarandache, Swiniarski, Tarokh, Valafar, Venkataraman, Vuskovic

Claremont Graduate University

Program Director: John Angus

Committee Members: Angus, Cumberbatch, Dewey, Landsberg, Nadim, dePillis, Liebesking-Hadas, Raval, Spanier, Wild, Williamson

Courses Acceptable on Master's and Doctoral Degree Programs in Computational Science (COMP)

UPPER DIVISION COURSE

COMP 596. Advanced Topics in Computational Science (1-4)

Prerequisite: Consent of instructor.

Advanced special topics in computational science. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree. Maximum credit of six units of 596 applicable to a bachelor's degree. Maximum combined credit of six units of 596 and 696 applicable to a 30-unit master's degree.

GRADUATE COURSES

COMP 600. Seminar (1-3)

Prerequisite: Consent of instructor.

An intensive study in advanced computational science. May be repeated with new content. Topic to be announced in the Class Schedule. Maximum credit six units applicable to a master's degree.

COMP 696. Selected Topics in Computational Science (3)

Prerequisite: Graduate standing.

Intensive study in specific areas of computational science. See Class Schedule for specific content. Maximum combined credit of six units of 596 and 696 applicable to a 30-unit master's degree.

COMP 797. Research (1-3) Cr/NC/RP

Prerequisite: Six units of graduate level computational science courses.

Research in computational science. Maximum credit six units applicable to a master's degree.

COMP 798. Special Study (1-3) Cr/NC/RP

Prerequisite: Consent of staff; to be arranged with program director and instructor.

Individual study. Maximum credit six units applicable to a master's degree.

COMP 799A. Thesis or Project (3) Cr/NC/RP

Prerequisites: An officially appointed thesis committee and advancement to candidacy.

Preparation of a project or thesis for the master's degree.

COMP 799B. Thesis or Project Extension (0) Cr/NC

Prerequisite: Prior registration in Thesis or Project 799A with an assigned grade symbol of RP.

Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis or project is granted final approval.

COMP 800. Seminar (3)

Prerequisite: Admission to the doctoral program.

Topics in different areas of computational science.

COMP 810. Colloquium in Computational Science (1) Cr/NC/RP

Prerequisite: Admission to the doctoral program.

Discussions on advances in computational science research. Course to be taken every semester.

COMP 890. Supervised Research and Qualifying Examination (3-6) Cr/NC/RP

Prerequisites: Admission to the doctoral program and consent of instructor.

Research and preparation for qualifying examination.

COMP 895. Dissertation Proposal (3) Cr/NC/RP

Prerequisites: Successful completion of qualifying examination and consent of instructor.

Research and preparation of dissertation proposal to be presented in order to advance to candidacy.

COMP 896. Practicum (1-9) Cr/NC/RP

Prerequisite: Admission to the doctoral program.

Independent investigation in general area of field of dissertation. Conducted in industry or national laboratory under faculty supervision. Maximum credit 36 units.

COMP 897. Doctoral Research (1-9) Cr/NC/RP

Prerequisite: Admission to the doctoral program.

Independent investigation in general field of dissertation. Maximum credit 36 units.

COMP 898. Doctoral Special Study (1-3) Cr/NC/RP

Prerequisite: Advancement to candidacy.

Individual study leading to study and research required for doctoral dissertation.

COMP 899. Doctoral Dissertation (1-15) Cr/NC/RP

Prerequisites: An officially constituted dissertation committee and advancement to candidacy.

Preparation of the dissertation for the doctoral degree.