

COMPUTER, ELECTRICAL, AND MATHEMATICAL SCIENCES AND ENGINEERING DIVISION FACULTY

Mohamed-Slim Alouini, Associate Dean, Computer, Electrical, and Mathematical Sciences and Engineering and Professor of Electrical Engineering
Research interests: modeling, design, and performance analysis of wireless communication systems; cognitive radio systems; cooperative/collaborative communication systems; multi-hop communication. (PhD, California Institute of Technology, US)

Hakan Bagci, Assistant Professor, Electrical Engineering
Research interests: applied and theoretical computational electromagnetics; using time domain integral-equation-based solvers to characterize wave interactions; fast hybrid methods for the analysis and statistical characterization of electromagnetic wave interactions; well-conditioned integral equation formulations; electromagnetic inverse scattering problems using signal processing techniques. (PhD, University of Illinois, US)

Vladimir Bajic, Director, Computational Bioscience Research Center and Named Professor, Applied Mathematics and Computational Science
Research interests: facilitation of biological discoveries through the use of sophisticated bioinformatic systems combined with data modeling methods; inferences from new information not explicitly present in biomedical data. (DEngSc, University of Zagreb, Yugoslavia)

Victor Manuel Calo, Assistant Professor, Applied Mathematics and Computational Science and Earth Science and Engineering and Co-Director, Center for Numerical Porous Media
Research interests: multiscale, multiphysics, and multiresolution modeling of geodynamics, porous media, fluid-structure interaction, and turbulence; algorithmic and theoretical aspects of high-performance computing and optimization. (PhD, Stanford University, US)

James Calvin, Vice President for Education and Professor, Applied Mathematics and Computational Science
Research interests: linear models; multivariate variance components; statistical methodology and applications. (PhD, Colorado State University, US)

Christian Claudel, Assistant Professor, Electrical and Mechanical Engineering
Research interests: control and estimation of distributed parameter systems; cyberphysical systems monitoring; use of wireless sensor networks for environmental applications. (PhD, University of California, Berkeley, US)

Mootaz Elnozahy, Dean, Computer, Electrical, and Mathematical Science and Engineering Division and Professor, Computer Science
Research interests: fault tolerance, power management, system architecture, distributed computing and operating systems, high performance computing, simulation tools. (PhD, Rice University, US)

Ian Foulds, Assistant Professor, Electrical Engineering
Research interests: microsystems fabrication with special interest in use of polymer materials; polymer resists and polymer-specific patterning techniques; low-cost deep-UV lithography; microsystems device design; microfluidics. (PhD, Simon Fraser University, Canada)

Andrea Fratolocchi, Assistant Professor, Electrical Engineering
Research interests: linear and nonlinear waves in disordered systems, with applications in energy, medicine, and materials science. (PhD, University of Rome, Italy)

Xin Gao, Assistant Professor, Computer Science
Research interests: bioinformatics; computational biology; designing algorithms and developing machine-learning techniques to solve problems in structural biology, systems biology, and biological sequence analysis; NMR-based protein structure determination; protein dynamics and function study; next-generation sequencing. (PhD, University of Waterloo, Canada)

Marc Genton, Professor, Applied Mathematics and Computational Science
Research interests: statistical analysis, modeling, prediction, and uncertainty quantification of spatio-temporal data, with applications in environmental and climate science, renewable energies, geophysics, and marine science. (PhD, Swiss Federal Institute of Technology of Lausanne, Switzerland)

Markus Hadwiger, Assistant Professor, Computer Science
Research interests: scientific visualization; petascale visualization and scientific computing; volume visualization; medical visualization; interactive segmentation and image processing; GPU-based algorithms; general-purpose computations on GPUs. (PhD, Vienna University of Technology, Austria)

Ibrahim Hoteit, Assistant Professor, Applied Mathematics and Computational Sciences
Research interests: data assimilation; inverse problems; ocean modeling; Red Sea circulation. (PhD, Université Joseph Fourier, France)

Muhammad Mustafa Hussain, Assistant Professor, Electrical Engineering
Research interests: integrating advanced nanomaterials with nanofabrication into ultra-low or no-power electronics and nano-systems to build integrated nanotechnology for energy, environmental, and medical applications. (PhD, University of Texas at Austin, US)

Panos Kalnis, Associate Professor, Computer Science
Research interests: database outsourcing; cloud computing; mobile computing; peer-to-peer; online analytical processing; data warehousing; spatial-temporal and high-dimensional databases; GIS; security-privacy-anonymity. (PhD, Hong Kong University of Science and Technology, Hong Kong)

Aslan Kasimov, Assistant Professor, Applied Mathematics and Computational Science
Research interests: analysis and numerical solutions of partial differential equations related to compressible flow; shock and detonation dynamics; combustion; fluid dynamics; nonlinear waves; hydrodynamic instability; traffic flow and congestion phenomena; multi-phase flow. (PhD, University of Illinois, US)

David Ketcheson, Assistant Professor, Applied Mathematics and Computational Science
Research interests: numerical analysis and hyperbolic partial differential equations; development of efficient time integration methods; wave propagation algorithms; modeling of wave phenomena in heterogeneous media. (PhD, University of Washington, US)

David Keyes, Named Professor, Applied Mathematics and Computational Science
Research interests: scientific computing; parallel algorithms; parallel performance analysis; computational aerodynamics; computational radiation transport; computational combustion; optimization. (PhD, Harvard University, US)

Jürgen Kosel, Assistant Professor, Electrical Engineering
Research interests: sensors for biological and technical applications, microsystems, biomedical engineering, magnetism, and materials science. (PhD, Vienna University of Technology, Austria)

Taous-Meriem Laleg-Kirati, Assistant Professor, Applied Mathematics and Computational Science
Research interests: applied mathematics, control systems, and signal analysis; new methods for signal analysis based on semi-classical approaches to the analysis of arterial blood pressure; modeling, identification, control, fault detection, and inverse problems, especially seismic inversion. (PhD, INRIA, France)

Peter Markowich, Distinguished Professor, Applied Mathematics
Research interests: partial differential equations in applications; mathematical analysis; numerical analysis; computational mathematics; mathematical modeling. (DTech, Vienna University of Technology, Austria)

Niloy Mitra, Associate Professor, Computer Science
Research Interest: symmetry and regularity detection in three-dimensional geometry shape analysis; inverse procedural modeling; inferring compact shape representations and abstractions; using inferred model properties for improved shape manipulation and understanding. (PhD, Stanford University, US)

Mikhail Moshkov, Professor, Applied Mathematics and Computational Science
Research interests: time complexity of algorithms; machine learning; discrete optimization. (PhD, Saratov State University, Russia; DSc, Moscow State University, Russia)

Boon S. Ooi, Professor, Electrical Engineering
Research interests: optoelectronic devices including LEDs and semiconductor lasers; solid-state lighting; photonics integrated circuits. (PhD, University of Glasgow, Scotland)

Arnab Pain, Associate Professor, Bioscience
Research interests: high-throughput sequencing and comparative genomics of human and animal pathogens; host-pathogen interactions; non-protein-coding RNAs; regulation of gene expression in apicomplexan parasites; deep sequencing of microbial populations to study natural and experimental genome and phenotypic diversity. (PhD, University of Cambridge, UK)

Helmut Pottmann, Director, Geometric Modeling and Scientific Visualization Research Center and Named Professor, Applied Mathematics and Computational Science
Research interests: computer aided geometric design; geometric modeling; geometry processing; geometric computing for manufacturing; scientific visualization; robot kinematics. (PhD, Vienna University of Technology, Austria)

Hany Ramadan, Assistant Professor, Computer Science
Research interests: operating systems; concurrent programming; databases; software and hardware for parallel programming. (PhD, University of Texas at Austin, US)

Timothy Ravasi, Associate Professor, Bioscience
Research interests: large-scale computer-aided modeling of biological signaling, transcription regulatory networks, and regulatory pathways, to integrate, model, and visualize data from biological experiments; metagenomic approaches for identified microbial bioactive molecules in the Red Sea. (PhD, University of Milan, Italy)

Khaled Nabil Salama, Assistant Professor, Electrical Engineering
Research interests: electronic circuit design and semiconductor fabrication; development of devices, circuits, systems, and algorithms to enable inexpensive analytical platforms for industrial, environmental, and biomedical applications. (PhD, Stanford University, US)

Ravi Samtaney, Associate Professor, Applied Mathematics and Computational Science
Research interests: alternative energy; computational fluid & plasma dynamics; magnetohydrodynamics. (PhD, Rutgers University, US)

Atif Shamim, Assistant Professor, Electrical Engineering
Research interests: personal area networks; automotive radars; wearable and implantable wireless sensors; wireless powering; renewable energy; RF system-on-chip design; on-chip antenna integration; miniaturization and characterization techniques; 3D system-on-package design. (PhD, Carleton University, Canada)

Basem Shihada, Assistant Professor, Computer Science
Research interests: optical networks; optical burst switched networks; network congestion control; transmission control protocol; wireless mesh networks; cognitive radios; mobility. (PhD, University of Waterloo, Canada)

Georgiy Stenichkov, Professor, Earth Science and Engineering
Research interests: climate modeling; numerical fluid dynamics; atmospheric physics. (PhD, Moscow Physical Technical Institute, Russia)

Shuyu Sun, Associate Professor, Earth Science and Engineering
Research interests: finite element methods; reservoir simulations; computational transport phenomena; molecular simulations. (PhD, University of Texas at Austin, US)

Ganesh Sundaramoorthi, Assistant Professor, Electrical Engineering
Research interests: computational methods information imaging; medical image analysis; visual recognition systems. (PhD, Georgia Institute of Technology, US)

Raul Tempone, Associate Professor, Applied Mathematics and Computational Science
Research interests: a posteriori error approximation and related adaptive algorithms for numerical solutions to various differential equations; development and analysis of efficient numerical methods for uncertainty quantification. (PhD, Royal Institute of Technology, Sweden)

Antoine Vigneron, Associate Professor, Computer Science
Research interests: algorithms design and analysis for motion planning; computational geometry; data structures; geometric optimization; combinatorial optimization; graph algorithms; computational biology. (PhD, Hong Kong University of Science and Technology, Hong Kong)

Peter Wonka, Associate Professor, Computer Science
Research interests: visualization; remote sensing; computer graphics with a focus on modeling and analysis of urban and geospatial data. (PhD, Vienna University of Technology, Austria)

Ying Wu, Assistant Professor, Applied Mathematics and Computational Science
Research interests: computational physics; effective medium theories; transport theory; time reversal imaging; super-resolution; implementation of fast algorithms in solving large-scale classical wave propagation problems. (PhD, Hong Kong University of Science and Technology, Hong Kong)

Xiangliang Zhang, Assistant Professor, Computer Science
Research interests: data mining; machine learning; artificial intelligence; complex systems modeling; large-scale data processing and analysis; streaming data mining and analysis; information retrieval, pattern analysis/ classification, web mining; autonomic, high performance distributed computer systems; data management; grid and cloud management; bioinformatics. (PhD, INRIA and Université Paris-Sud 11, France)

<http://cemse.kaust.edu.sa>



COMPUTER, ELECTRICAL, AND MATHEMATICAL SCIENCES AND ENGINEERING DIVISION

KAUST – Through inspiration, discovery

King Abdullah University of Science and Technology (KAUST) attracts top international faculty, scientists, engineers, and postgraduate students to conduct fundamental and goal-oriented research to address the world's pressing scientific and technological problems. The University is committed to cutting-edge research in the areas of water, food, energy, and the environment (including the Red Sea) with a strong emphasis on computational science.

The University engages students, researchers, and faculty in advancing science and technology through collaborative inquiry of regional and global significance. The University's unique matrix structure supports both basic and goal-oriented research to benefit Saudi Arabia and beyond.

KAUST offers its students rich opportunities for learning, discovery, and research. With a student body representing over 70 nations, the University is committed to attracting and educating the world's most gifted and inspired scholars. Students, faculty, and researchers cultivate a dynamic and collaborative environment of bold scientific research and innovation. KAUST is where adventurous and imaginative individuals engage in a journey of intellectual and cultural discovery.

WHY CHOOSE KAUST?

KAUST is a graduate-level research university located on the shores of the Red Sea in Saudi Arabia. The University offers master's (MS) and doctoral (PhD) degrees in three academic divisions: Biological and Environmental Sciences and Engineering; Computer, Electrical, and Mathematical Sciences and Engineering; and Physical Sciences and Engineering. The University's new facilities with state-of-the-art technology offer an ideal setting to study and to conduct high-impact research.

- World-class faculty directs the University's talented postgraduate students, researchers, and postdocs
- Research Centers provide an environment that promotes targeted goal-oriented research
- Guaranteed funding ensures continuity and the highest quality research in water, food, energy, and the environment
- Core facilities include Advanced Nanofabrication, Imaging, and Characterization (microscopy, NMR, thin films); Bioscience (genomics, proteomics, bioinformatics); Supercomputing (Shaheen-IBM Blue Gene); and Visualization (3D display environment, virtual reality)
- Extensive collaboration with industrial partners encourages internships that lead to job opportunities for graduates
- Attractive residential campus enhances research and quality of life

KAUST FELLOWSHIP

All students receive the benefits of the KAUST Fellowship (the University's scholarship program):

- Full tuition support
- Competitive monthly living allowance
- Housing
- Private medical and dental coverage
- Relocation support

COMPUTER, ELECTRICAL, AND MATHEMATICAL SCIENCES AND ENGINEERING DIVISION

The Computer, Electrical, and Mathematical Sciences and Engineering Division (CEMSE) is home to applied mathematics, computer science, and electrical engineering. Much of the division's research lies in areas at the intersections of these disciplines, computer engineering and computational science and engineering.

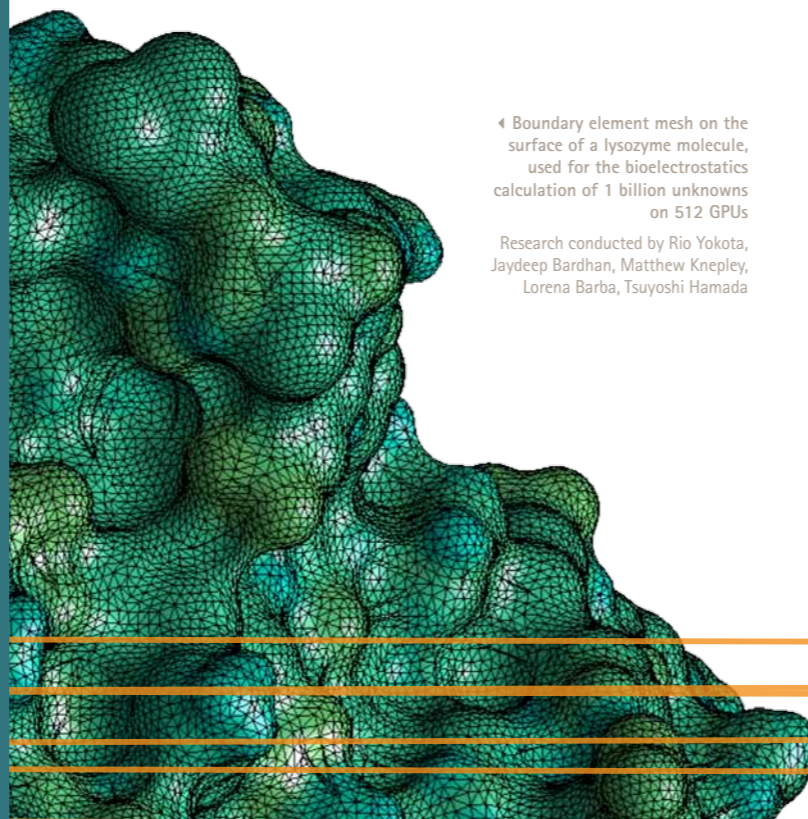
Each of the programs in CEMSE consists of a set of core courses and allows a choice of several academic tracks, ensuring that students have a solid foundation in their discipline while also allowing them to choose a curriculum that fits their own professional goals.

CEMSE teaching and research takes advantage of KAUST's Shaheen BlueGene massively parallel computer, one of the most powerful supercomputers hosted by any university in the world. Also at KAUST is "Cornea," a six-wall immersive CAVE, the most densely pixelated and powerfully illuminated advanced computation and visualization facility in the world, which permits high-resolution visualization and insonification of simulated and observed three-dimensional, time-evolving data sets. KAUST's nanofabrication facility permits prototyping of novel electronic devices and microsystems without leaving the campus. CEMSE research projects include core mathematical and computational techniques, as well as enabling technologies applied to real science and engineering problems that arise through collaborative work.

The CEMSE Division is aligned with KAUST's mission to expand the frontiers of knowledge in science and engineering and to help diversify the regional economy to one that is information and service based. Key to its success is to fully exploit its resources: its computational and network infrastructure, its national and international collaborations with academic and industrial partners, and its highly competitively recruited faculty and students.

All the programs of the CEMSE Division are committed to providing students a stimulating, challenging, rewarding, state-of-the-art, and career-launching environment.

The CEMSE Division hosts two university-wide strategic initiatives in the quantification of uncertainty in scientific and engineering simulation and the numerical modeling of porous media.



◀ Boundary element mesh on the surface of a lysozyme molecule, used for the bioelectrostatics calculation of 1 billion unknowns on 512 GPUs

Research conducted by Rio Yokota, Jaydeep Bardhan, Matthew Knepley, Lorena Barba, Tsuyoshi Hamada

DEGREE PROGRAMS

APPLIED MATHEMATICS AND COMPUTATIONAL SCIENCE (AMCS)

The Applied Mathematics and Computational Science program at KAUST prepares students for success in constructing computational solutions to mathematical problems in a variety of areas. This preparation emphasizes the fundamentals of modeling, analyzing, and computationally solving problems in many disciplines. The AMCS program offers six tracks, each of which leads to a frontier of applied and computational mathematics. These tracks are Computational Geoscience; Geometric Modeling and Scientific Visualization; Information Science; Modeling and Numerical Simulation; Computational and Mathematical Bioscience; and Partial Differential Equations.

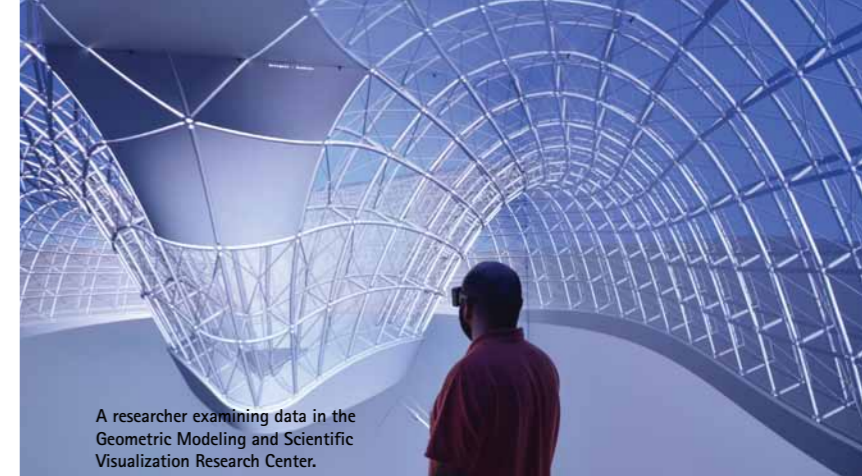
The Applied Mathematics and Computational Science program aligns with KAUST's research mission directly through its Computational Science and Engineering activities, as emphasized in the Modeling and Numerical Simulation and Geometrical Modeling and Scientific Visualization tracks, among others. A key driver in contemporary scientific discovery and engineering design is the merger of large-scale data sets from observation or experimentation with large-scale simulations. The mathematics that allows these two approaches to merge in such a way that the errors inherent in each may be reduced in the combination goes under a number of rubrics, including data assimilation, inverse problems, uncertainty quantification, and sensitivity analysis.

Another key driver is the merger of large-scale data sets and simulations with high-resolution visualization, so that scientists can interact in real time with their data. This merger opens up exciting possibilities like real-time computational steering and the engagement of the brain's innate skill at detecting changes in imagery. Water, food, energy and environmental research are all data rich, and most research campaigns now include a significant simulation component.

COMPUTER SCIENCE (CS)

The mission of the Computer Science program is directly aligned with KAUST's mission to expand the frontiers of knowledge in science and engineering. A key driver in contemporary scientific discovery and engineering design is the emergence of large-scale simulation, which accompanies the traditional modalities of theory and experiment. As simulation becomes relatively cheaper and experimentation becomes relatively more expensive, computation is increasingly used to narrow the parameter regimes in which experimentation is performed. Another driver is the availability of large-scale data sets from such sources as satellites, sensors, and the Internet as well as high-resolution and high-throughput experiments. The requirement for high performance stresses all aspects of computation: hardware, operating systems, languages, algorithms, etc.

Water, food, energy, and environmental research are all data rich, and most research programs now include a significant data analytics component. KAUST computer scientists contribute to the cyberinfrastructure that supports all such activities, and they collaborate in specific applied research campaigns. The Computer Science program at KAUST prepares students for success in creating and applying computational methods to a variety of areas. Course preparation emphasizes both the fundamental and enabling aspects of information technology at multiple levels: hardware and software, compute-intensive, and data-intensive. Tracks of specialization in CS include: Artificial Intelligence, Computer Systems, High Performance Computing, Visual Computing, Computational Bioscience, and



A researcher examining data in the Geometric Modeling and Scientific Visualization Research Center.

Theoretical Computer Science. Computer Science research and education emphasizes such areas as visualization, algorithms, databases, and networks.

The Computer Science program hosts a university-wide strategic initiative in extreme computing.

ELECTRICAL ENGINEERING (EE)

Boasting superb facilities and resources, the Electrical Engineering program gives students access to the latest supercomputing and visualization facilities along with superbly equipped experimental laboratories.

The Electrical Engineering program has two major tracks: Electrophysics, specializing in solid state physics and electronics, circuits, microsystems, electromagnetics, and photonics; and Systems, specializing in communications, computer networks, signal processing, and control. These tracks cover the most important areas in modern-day electrical engineering and will equip the student for a successful and productive career in these fields.

With research groups working on computational electromagnetics, integrated nanotechnology, sensing, magnetism and microsystems, and sensors, the Electrical Engineering program attracts high-caliber students who seek to work on cutting-edge research projects. The Electrical Engineering program is committed to providing all students in the program a stimulating, rewarding, and challenging research environment.

The Electrical Engineering program hosts a new center, sponsored by the Saudi research agency King Abdulaziz City for Science and Technology (KACST), in solid-state lighting.

ENGLISH LANGUAGE REQUIREMENT

All courses are taught in English and students must meet the minimum language requirement: 79 on the TOEFL iBT (internet based test) or 6.0 on the IELTS test.

FOR APPLICATIONS OR INQUIRIES OFFICE OF ADMISSIONS

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