CONNECTION

Advancing the Science of Guidance, Navigation, and Control

During the Age of Exploration in the 15th through 17th centuries, navigation was the greatest scientific challenge. Today, knowledge about guidance, navigation, and control (GNC) systems has never been more important. The GNC system is the technological brain that safely controls everything from satellites and rockets to robots and autonomous land, sea, and air vehicles.

To promote proficiency in these evolving technologies, Cal State Fullerton's College of Engineering & Computer Science is establishing a new Center for Navigation to focus on education, research, and industry partnership.

"Everything we do here will be targeted to stay in front of industry's technological needs for

advanced GNC systems," says Jidong Huang, professor of electrical engineering and one of the faculty sponsors for the Center.

Ultimately, the goal of the Center will be not only to transform ECS into a national leader for research and innovation in areas related to navigation, but also to serve as a hub for providing

instructional support, professional engagement, and outreach activities for the field. To get there, the Center will adopt a multipronged strategy geared toward maximizing the benefit for students, faculty, industry partners, and the broader community.

Encouraged by Industry Partners

CSUF, in partnership with industry, has a long history of advancing GNC research activities. Input from those partners was the impetus for Huang and Mohinder Grewal, professor emeritus of electrical engineering, to write the proposal to establish the Center.

"Companies lack qualified candidates for important jobs in navigation engineering," says Huang. "We know that if we were going to prepare our students appropriately for these jobs, we would need a dedicated center where we can not only establish a targeted curriculum but also provide research opportunities that will meet the needs of our industry partners."

The Center will allow ECS to consolidate all of its navigation-related instructional and research activities under one umbrella. This hub will make it easier for faculty and students to collaborate and partner with industry on interdisciplinary applied research projects and engage in curricular leadership in the area of GNC.

Raytheon, one of ECS's industry partners, is an early supporter.

"Navigation technology is ubiquitous across a wide range of industries. With a global presence in satellite navigation, Raytheon values engineers with knowledge and experience in navigation, guidance, and control applications," explains Laura Cheung, Raytheon Wide Area Augmentation System (WAAS) integration and test director. "Our company has therefore provided seed money to form the new Center for Navigation to support student research and design projects, as well as curriculum development and scholarship. Ultimately, we hope the Center will become a national leader in navigation research and innovation."

Focused on a Collaborative Curriculum

The Center for Navigation will take a collaborative approach to curriculum development, working closely with industry partners and faculty from the different departments and colleges at CSUF.

"We want to listen to industry and also want to incorporate high-impact hands-on active learning to support students," says Huang. "By working with faculty from across our college and campus, we intend to be collaborative and efficient in developing a meaningful curriculum."

Curriculum development will include new courses and enhancements to existing courses to reflect the technological developments in the field. Ultimately, Huang would like to see a new GNC concentration for the bachelor's and master's electrical engineering programs. "This will provide students with more choices in course enrollment and support timely graduation," he says.

GNC education involves much more than electrical engineering. It requires knowledge in mechanical engineering, computer engineering, computer science, mathematics, and more.

A Message from the Dean

SUSAN BARUA
DEAN, COLLEGE OF ENGINEERING & COMPUTER SCIENCE

As new breakthroughs in computer science and engineering continue to rapidly transform our economy and our society, Cal State Fullerton has become increasingly committed to providing our students with the types of skills and experiences that set them up for success in the 21st century.

Building on the successful model we have developed with the ECS Center for Cybersecurity, the college is proud to announce a new Center for Navigation. This Center will focus primarily on education, research, and industry partnership to advance innovation in guidance, navigation, and control. The Center has already gained interest from industry leaders like Raytheon.

In addition to the new Center, we have just finalized a three-year grant with Mercury Systems, where a team of students is using machine learning and artificial intelligence to enhance radar detection systems research and student projects. In December we celebrated 15 years of partnership with Disneyland. We are a driving force in preparing Orange County's workforce and look forward to expanding our industry partnerships.

All of this would not be possible without you, our alumni and supporters. Thank you for continuing to give your time, talent, and financial support. It truly "takes a Titan" to prepare our graduates for exciting and rewarding careers. Please share your successes with us as well and help us inspire future generations of Titans. ⚙

> ## "Everything we do here will be targeted to stay in front of industry's technological needs for advanced GNC systems."
>
> **JIDONG HUANG**
> PROFESSOR OF ELECTRICAL ENGINEERING

Therefore, the Center will focus on collaborative, project-based learning, which has been a foundational element in the ECS curriculum.

"It's our intent that students with different backgrounds and levels will be able to work together at the Center, which will foster active learning, peer mentoring, and opportunities for interdisciplinary study," says Huang. "By engaging in project-based learning and research, our students will gain career-readiness skills like idea generation, project design and management, prototyping, and engineering implementation."

Students' participation in research enhances their learning experiences and is one of the best predictors of their success beyond graduation, data show. That's why the Center will be a point of contact for faculty to recruit students for projects, and for students to seek collaborative research opportunities. "The Center will provide students opportunities to interact with faculty outside of classroom instruction and develop important skills like critical thinking and communication," explains Huang.

A Hub for New Tech Development

Partnership between academia and industry is natural when it comes to collaborative research and development of new technology. The Center will be geared to carry on the legacy research ECS already engages in with industry. In addition, it will establish a community of faculty and student scholars that works together on applied research, resulting in peer-reviewed publications and grant proposals.

"Our goal is that research activities at the Center will result in the creation of new technology and engineering approaches and solutions, such as improved navigation algorithms and methods that can be quickly adopted by the industry to increase or improve their product lines," explains Huang.

The Center will seek to expand its engagement with local industry through informal consultations and eventually the establishment of an advisory board. To sustain its research activities, the Center will help faculty develop grant proposals and industry support.

"CSUF is strategically located in a business district where major industry players, including Raytheon, Boeing, Garmin, Northrop Grumman, John Deere, Trimble, and many other GNC-relevant companies have a strong presence," says Huang. "The Center will help us collaborate with industry on a deeper level in order to develop additional partnerships that will support long-term, sustained GNC research projects." ⚙

Hands-on Experience at the Happiest Place on Earth

Pictured are (left to right): Susan Barua, Dean; Darrell Jodoin, Director of Global Development at Walt Disney Parks and Resorts; Patrick Doyle, Director of Design & Engineering at Disneyland Resort; and Michael Karg, Senior Director of Development.

If you've visited Disneyland Resort, you've likely experienced the magic and excitement of its shows and attractions, all carefully crafted originally by "Imagineers." But have you ever thought about the design and engineering that goes on behind the scenes to sustain these great experiences? Over the last 15 years, many College of Engineering & Computer Science students have had the opportunity to play a part in Disneyland Resort's technical process, gaining valuable experience while bringing fresh ideas and solutions to the resort.

Mechanical engineering alumnus Darrell Jodoin (BS '85), director of Global Development Facilities Operations Services for Walt Disney Parks and Resorts, helped kick off this powerful partnership in 2004. Initially, Disneyland Resort sponsored tech breakfasts and sent speakers to the college, but the relationship soon provided something more. Even more recently, in 2019, the college named Disneyland Resort its Corporate Partner of the Year.

"When Disney transitioned to supporting students in their senior design projects through the Corporate Partners Program, we got more of our engineers involved in the mentoring piece and gained direct exposure to ECS students, their talents, and their ability to apply what they'd learned," says Jodoin. "We invite students onto the Disney property and enlist their help with the real, tangible projects we're working on."

For one memorable project, Jodoin says student engineers were tasked with developing a robot to assist with track inspections on various Disneyland Resort attractions. "We gave them the idea, and they took it from there," he says.

The relationship is symbiotic, says Jodoin. ECS students get hands-on experience with all aspects of the engineering process – planning, budgeting, designing, building, and testing. Disney supports their projects through the Corporate Partners membership and mentors the teams, letting them learn throughout the process.

The students bring fresh eyes, an industrial "innocence" that drives questions and sometimes leads to a new way of looking at things – even among the most seasoned engineers.

Making Their Mark on the Magic

Often, the real-world experiences that Disneyland Resort offers ECS students include a very realistic schedule. Students must join technicians and engineers at the park at 3 or 4 a.m., before it opens, to check out the design challenges. They must also prepare to encounter bumps in the road as they plan and execute their designs.

"As an engineer, you're getting into the problem-solving business," says Jodoin.

Jodoin says he's been well-served by his ECS education that gave him "a strong technical background, anchored in theory, with the approach that you need to go apply it." When he was directly involved in senior design projects, he was continually impressed by students' drive and work ethic. After his promotion a few years ago, Patrick Doyle, director of Design & Engineering at Disneyland Resort, took the partnership's reins – and has been equally happy with the outcomes.

"I've long seen the importance of this relationship for the college and for Disneyland," says Doyle. "Students are excited to be engaged in Disney projects, and that excitement rubs off on our Cast Members. And these young engineers learn what it truly takes to plan and accomplish a project."

Doyle says he was especially impressed with a recent student team that worked closely with a Disney mechanical engineer to design rear steering for longer-length parade floats, a feature that would allow floats to navigate tighter turns.

"Their work earned them third place out of 96 projects in the ECS Student Projects Showcase and Awards," says Doyle. "They put in a lot of hard work and came up with some great ideas we will look at when we address that need. We're thrilled to see outcomes like these, signs of personal and professional growth under the mentorship of our people." ⚙

Mercury Systems Invests in Tomorrow's Engineers

When a group of College of Engineering & Computer Science students recently toured Mercury Systems' facilities, Chief Technologist Tony Girard took a minute to appreciate the moment.

"I'm always encouraged when I see Cal State Fullerton students here," he says. "Helping students learn and develop the skills that are now in demand sets them up for success. It also helps ensure Mercury remains an innovative leader in defense technology."

Mercury and CSUF have a longstanding relationship: Many employees are alumni and the company sponsors ongoing projects through the ECS Corporate Partners Program. The company recently finalized a $300,000 grant to support a research project in intelligent radar systems and to enhance the college's artificial intelligence and machine learning curriculum. One of those projects was the reason for the students' visit to Mercury.

"Professor Kiran George is leading a team of two graduate students and five undergraduates for a collaborative research project. The project is scheduled to last three years and will benefit the college and ECS students," explains Girard. The project will provide students vital hands-on skills that will prepare them for the workforce and give them the opportunity to directly impact the important work Mercury does in making trusted, secure mission-critical technologies profoundly more accessible to the aerospace and defense industries.

> "Helping students learn and develop the skills that are now in demand sets them up for success."
>
> **TONY GIRARD**
> CHIEF TECHNOLOGIST
> MERCURY SYSTEMS

At Mercury, Girard works in signals intelligence/identification for electronic warfare applications. His team is responsible for developing innovative systems and solutions that can test and overcome advanced radar and jamming threats.

"We are working to develop better ways of finding signals that people are trying to hide, and artificial intelligence and machine learning are promising tools to help us detect signals that look different every time you see them, or that are constantly changing frequency. The goal is for our radar systems to be able to recognize and predict these patterns," he says.

In order to remain competitive, Mercury takes a great interest in supporting future engineers who could someday become Mercury innovators. That's why Girard serves on the ECS College Leadership Council, advising the dean and supporting faculty-led programs and research. "It's an opportunity to provide input into the development of students as they go from learning concepts to applying that knowledge and preparing for careers in the industry," he says.

COLLEGE NEWS

New Scholarship Announcement

The Dr. Pinaki Chakrabarti Scholarship in Civil and Environmental Engineering was established by **Pinaki Chakrabarti**, professor emeritus of civil and environmental engineering, and his family and friends in recognition of his more than three decades of service to the department, including 12 years as department chair. Department of Civil and Environmental Engineering students committed to entering a career in civil and environmental engineering are eligible for this award.
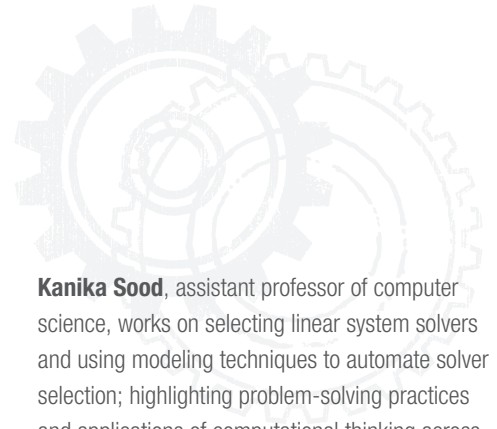
FACULTY FOCUS

Welcome, New Faculty

Jaya Dofe, assistant professor of computer engineering, focuses on addressing security threats in modern hardware design and fabrication.

Jangyoung (Chris) Kim, assistant professor of computer science, researches data-intensive computing, big data analytics, cloud computing and security, and computer network systems.

Shilpa Lakhanpal, assistant professor of computer science, studies data mining, machine learning, artificial intelligence, and natural language processing.

Huda Munjy, assistant professor of civil and environmental engineering, focuses on earthquake engineering, loss estimation of buildings, and statistical tools used to assess earthquake-related loss of structures.

Kanika Sood, assistant professor of computer science, works on selecting linear system solvers and using modeling techniques to automate solver selection; highlighting problem-solving practices and applications of computational thinking across disciplines; and applying machine learning techniques to cancer prognosis.

Xenia Wirth, assistant professor of civil and environmental engineering, examines fundamental soil behavior, such as how changes in the microstructure and chemistry influence the behavior of soil systems. In addition, she focuses on beneficial use and responsible disposal of coal and biomass combustion residuals.

Jin Woo Lee, assistant professor of mechanical engineering, focuses on design theory and methodology, product design, medical device design, creativity and innovation, front-end design processes, and engineering education.

A Google Engineering Culture Experience

Paul Salvador Inventado, assistant professor of computer science, was selected for Google's Faculty in Residence program and spent four weeks last summer at the tech company's Mountain View headquarters. He participated in hands-on, project-based learning workshops and explored resources to augment course curriculum.

Support for Their Smart Tree

Kiran George, professor and program coordinator of computer engineering, and **Sagil James**, assistant professor of mechanical engineering, received a $15,000 SoCalGas grant in support of their Titan Smart Tree project. They developed this self-sustaining carbon-capturing system to absorb and store carbon dioxide from indoor/outdoor atmospheres, leaving the air fresher. This grant will help them develop a public education display about clean air at the Fullerton Arboretum that is focused on the Titan Smart Tree's capabilities.

Congrats to an Outstanding Faculty Advisor

Sudarshan Kurwadkar, associate professor of civil and environmental engineering, received the 2019 American Society of Civil Engineers (ASCE) Outstanding Faculty Advisor award from the ASCE Los Angeles Section.

STUDENT NEWS

Saving Lives After Hurricane Dorian

A cloud-based dispatch system created by computer science senior Bryan Ruef helped first responders rescue more than 500 people in the Bahamas after Hurricane Dorian.

Florida Search and Rescue and Crowd Emergency Disaster Response Digital Corps, working with the Federal Emergency Management Agency in the Bahamas, used Ruef's software – 10-8 Systems – in their search and rescue operations.

10-8 Systems enables a dispatcher to quickly identify the exact GPS location of the caller. Rescue calls from multiple agencies can be put into one universal queue and response status can be tracked. The system is cloud-based and accessible via cell phones, tablets, or computers.

Since the company was founded in January 2019, 10-8 Systems has handled more than 27,000 incidents in 1,200 cities across 41 states. A key turning point for 10-8 Systems came in the spring of 2019 when Atul Teckchandani, associate professor of management and entrepreneur-in-residence in the College of Engineering & Computer Science, suggested

> 10-8 Systems has handled **more than 27,000 incidents** in 1,200 cities across 41 states since January 2019.

that Ruef participate in the CSUF Startup Competition. The competition was the first time Ruef had ever pitched his business, but he impressed the judges and took first place, winning a $1,000 scholarship and six months in the CSUF Startup Incubator.

Ruef credits the competition's preparation process and the CSUF Startup Incubator for putting 10-8 Systems on the path to success. The company now has a team of seasoned business professionals providing advice and supporting corporate growth. ☼

Offensive Security Society Team Wins H1-213 Event

Congratulations to Cal State Fullerton's Offensive Security Society (OSS) team, which placed first at HackerOne's h1-213 event in November 2019. During this event, 75 hackers attempted to hack real targets: the United States Air Force and Verizon Media. Computer science juniors **Rojan Rijal** and **Brandon Nguyen**, who are CSUF OSS board members, worked with two security engineers on the "StraightOuttaLA" team. After two weeks of hacking, the team placed first and won multiple Air Force–issued awards.

Titan Team's Roller Coaster Takes Silver

Mechanical engineering undergraduates **Patrick Babb**, **James Barnett**, and **Mitchell Kitazumi** designed a nearly 100-foot-high, adrenaline-inducing thrill ride that earned a silver medal in the University Physics Competition, sponsored by the American Physical Society and the American Astronomical Society. The international collegiate competition attracted more than 300 college teams, and the CSUF team ranked among the top 20 percent of competitors worldwide.

Hundreds of visitors of all ages joined ECS students for the 12th annual pumpkin launch event on Nov. 2, 2019. Students showcased their engineering skills, building trebuchets and cannons, wowing local kids and inspiring them at the fun-filled STEM festival.

Support the College of Engineering & Computer Science.

Your gifts, your service, and your talent are fundamental to our goal of preparing graduates to solve 21st-century problems. *Here's how you can get involved with the college:*

PLANNED GIVING AND DEFERRED GIFTS
Planned gifts can provide significant benefits to you and your family, now and in the future, while supporting generations of Titans to come. Consider including a bequest provision in your will or naming the College of Engineering & Computer Science at Cal State Fullerton as a beneficiary of your life insurance policy or retirement plan. Regardless of its size, your gift will make a difference in the lives of our students.

DONATE NOW
at giving.fullerton.edu

DONATE LATER
at csufplannedgift.org

VOLUNTEER OPPORTUNITIES
Share your career development experiences in the classroom, mentor an aspiring professional, or serve a department or program in an advisory capacity.

INDUSTRY PARTNERSHIPS
Connect the college with your company – we're continually seeking partnerships that provide student project support, internship, and employment positions for our graduates, targeted research opportunities for faculty, and industry links that help facilitate curricular currency.

CALL FOR GUEST PROFESSORS
Interested in sharing your professional experience with ECS students? Sign up to be a "Professor for a Day." Contact Michael Karg, senior director of development, at **mkarg@fullerton.edu** today.

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