MISSOURI S&T

Electrical and Computer Engineering Department

Five Year Program Assessment

Self Study Report

2025

MISSOURI S&T

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EXECUTIVE SUMMARY

Dr. Kimball
Department Chair

MISSOURI S&T™

Electrical and Computer Engineering Department
College of Engineering and Computing

The Electrical and Computer Engineering department has a long history of excellence. We celebrated our centennial in 2024, one hundred years of existence as a standalone department. Enrollment trends are positive once again and our research and scholarly productivity continues to increase.

The department holds a leading position on campus even though the past decade has witnessed the retirement or departure of several senior faculty who were highly prolific researchers and others who were committed teachers and active in shared governance. Total research expenditures over the past five years are second only to Materials Science & Engineering. Seven active faculty were identified in a Stanford study as in the top 2% in their respective fields. ECE faculty hold leadership positions across campus as directors of two research centers, associate dean of research, faculty ombuds, and president of graduate faculty.

Like many institutions, we face significant challenges related to financial resources and student recruitment. Funding for miscellaneous instruction, that is, laboratory teaching assistants and adjunct faculty, is uncertain and usually inadequate. Undergraduate recruiting is highly competitive and is impacted by the declining population of college-bound high school students. Graduate recruiting is also highly competitive on the international stage, a situation aggravated by immigration uncertainties.

Yet we are hopeful about the future. After declining for about a decade, undergraduate enrollment has begun to increase again. Graduate enrollment also looks to be rebounding, driven in part by our new accelerated programs that enable our own undergraduates to earn a graduate degree more quickly. Funding from endowments, donations, and our cooperative program at Missouri State University is available to supplement general revenue allocations and enable strategic investments, most notably in equipment.

This self-study report provides information toward the Program Assessment and Periodic Review (PAPR) of the programs of the Electrical and Computer Engineering department. The purpose of the review is improving the quality of the educational opportunities provided by the academic unit in the areas of student learning, research, scholarship and creativity, and service. This report is to provide fact-based qualitative and quantitative documentation for evaluation of the department's varied programs. It is designed to address the quality, productivity, and viability of the programs. The process is intended to be used for strategically aligned growth, improvement or adjustment in response to findings, and recommendations from the review process.

Contents

Department Profile

Dr. Floyd H. Frame was Missouri S&T's founding chair of electrical engineering, serving in the role from 1924-1948

History of the ECE Department

In 1924, Missouri S&T was called the Missouri School of Mines and Metallurgy, its student newspaper had advertisements for 35-cent haircuts, there were 353 students enrolled in fall classes, with 111 of them being freshmen — and the electrical engineering department was officially created.

Fast-forward a century, and that department, which now is called electrical and computer engineering, recently celebrated its centennial during S&T's Homecoming weekend and has hundreds more students in its programs than the entire university had enrolled at the time of its inception.

According to Dr. Larry Gragg, the university's historian and a Curators' Teaching Professor emeritus of history and political science, electricity was a topic in a professor's lecture as early as 1876, and the first class focused entirely on electricity was offered in 1891.

Not long after that, the university offered a two-year program focused on practical electrical engineering. S&T's efforts toward potentially offering an electrical engineering bachelor's degree program were met with some controversy due to the University of Missouri's competing program, but in 1915, the Missouri legislature passed the Buford Act, which approved S&T to offer degrees in electrical, chemical and mechanical engineering.

The university's electrical engineering major was first offered through the physics department, and in 1917, that department's name became physics and electrical engineering.

The following year, a student named Harry Tobias Heimberger completed his bachelor's degree in electrical engineering, becoming the first student.

But it would still take six more years for electrical engineering to become its own department.

In the century since its establishment, the electrical and computer engineering department has undergone significant changes and expansions, with many opportunities on the horizon.

Department Vision, Mission and Values

Missouri S&T Vision

Missouri S&T will be the leading public technological research university for discovery, creativity and innovation.

We will cultivate curiosity, creativity and confidence in our graduates. We will be the institution of choice for partners around the world seeking a highly qualified, talented and entrepreneurial workforce; innovative research; relevant education programs, products and services; and technology and ideas to solve the great challenges of our time.

College of Engineering and Computing

As a top-ranked public engineering college, we will lead the way in shaping the future of engineering and computing education and research by growing the S&T brand of excellence and providing our students with unmatched quality and breadth of expertise and opportunities. This includes expanding student recruitment efforts, pioneering new degree programs to meet future workforce needs, and developing a sharp focus on research dedicated to addressing grand societal challenges and serving the public good of our state and region. Our college will become the destination of choice for students, faculty and staff.

To that end, the CEC two-fold mission is to:

- Provide our students with a transformative education that prepares and inspires them to shape the future.
- Lead the way in improving our world and solving grand societal challenges through research and innovation.

Department Educational Mission

In alignment with the university and college mission and vision, the ECE faculty developed a mission statement with input from employers and alumni and the Academy of Electrical and Computer Engineering. (The Academy of ECE comprises many distinguished alumni, who have graduated a minimum of 20 years prior to their induction.)

The Electrical and Computer Engineering Department strives to contribute to the state, nation, and world through the education of outstanding professionals and leaders in engineering. Our educational focus is on a broad, rigorous education in all areas of electrical and computer engineering with significant experiential learning. The programs will provide students with a broader understanding of issues in understanding of engineering problem solving at all levels and an appreciation for engineering as a profession.

Department Structure, Faculty, Staff and Facilities

Department Structure

The Department of Electrical and Computer Engineering has 21 tenured faculty, 4 untenured tenure-track faculty, 5 non-tenure-track teaching faculty, and 5 non-tenure-track research faculty. Among the tenured faculty, one has a major administrative position with no teaching duties, two have administrative positions with substantially reduced teaching loads, and eight have other service roles that provide course release. The department has 8 staff, of which 4 are office support staff and 4 are technical staff. In addition, advising is primarily provided by two professional advisors (one of whom is shared with Computer Science) who formally report to the College of Engineering and Computing

(CEC) but whose offices are embedded in our department. Finally, business and HR support are provided by CEC-level service centers.Compatibility, is housed at a facility in Hy-Point, an industrial park 4 miles from campus.

Primary activities all occur in Emerson Elec. Co. Hall, which has offices for all faculty, eight classrooms, eight teaching laboratories, and several research laboratories. A major research group, the Center for Electromagnetic Compatibility, is housed at a facility in Hy-Point, an industrial park 4 miles from campus.

Missouri S&T and Missouri State University (located in Springfield, MO) have a cooperative engineering program. Housed in the Plaster Center, the program offers electrical, mechanical, and civil engineering degrees to MSU students. Essentially, students take non-engineering courses from MSU and engineering courses from S&T, ultimately receiving an S&T degree. The electrical engineering degree is supported by three faculty in Springfield: two NTT teaching faculty employed by S&T and one tenured associate professor employed by MSU. Additional coursework is supplied by Rolla-based faculty teaching remotely.

An organizational chart is given in Figure 1

Figure 1 ECE Organizational chart

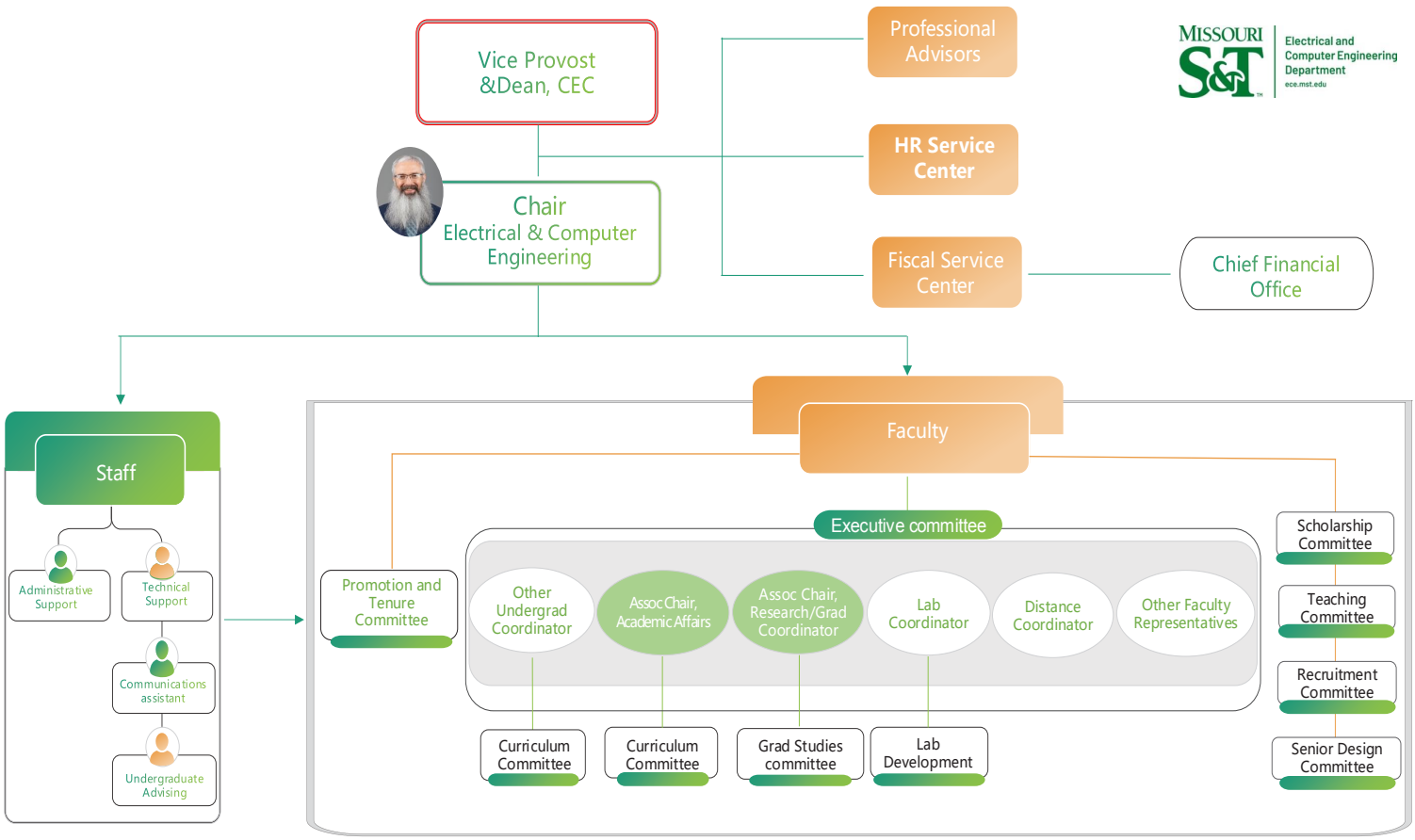


Figure 2 ECE Faculty Directory

Dr.Rex Gerald is a part-time professor

Dr.Tayo Obafemi-Ajayi is employed by Missouri State university,but teaches our courses.

Faculty

The total number of tenured and tenure-track faculty in ECE has been largely stable over the past five years at 25. Additionally, five non-tenure-track teaching faculty have supplemented our teaching capacity. Brief biographical information on all current faculty is provided in an appendix. Faculty count by rank and category is given in Tables 1 and 2.

The most notable change evident in Tables 1 and 2 is an increase in non-tenure-track research faculty. These positions are entirely funded by external research grants and contracts. Research faculty have no teaching duties and minimal service expectations, but amplify the department's research productivity.

Non-tenure-track faculty (both teaching a length from one to three years. They are able to progress through the ranks of assistant,associate, and full professor but are not eligible for tenure.

The biographical information in the appendix indicates the emphasis area within ECE for each faculty member. Many faculty teach and/or perform research in multiple areas, including areas within both electrical and computer engineering programs. Several faculty also have courtesy appointments in other departments, primarily computer science and physics.

Table 1 Faculty count by category

Category	2020	2021	2022	2023	2024
Untenured TT	7	6	5	4	4
Tenured	18	19	20	22	21
NTT Teaching	5	5	5	5	5
NTT Research	2	1	1	3	5
Total	32	31	31	34	35

Table 2 Faculty count by rank and classification

Rank	2020	2021	2022	2023	2024
Assistant	7	6	5	4	4
Associate	7	8	9	10	9
Full	11	11	11	12	12
Assistant Teaching	1	1	1	0	0
Associate Teaching	4	4	3	4	4
Full Teaching	0	0	1	1	1
Assistant Research	0	0	0	2	3
Associate Research	2	1	1	0	1
Full Research	0	0	0	1	1
Total	32	31	31	34	35

Staff

The department currently has eight full-time staff members as listed in Table 3.

Over the past several years, a few departmental functions have been centralized to the College of Engineering and Computing. There are two service centers in CEC, one focused on human resources functions and one focused on financial functions. In addition, professional advisors who once reported to departments now report to a lead advisor within CEC to enhance coordination among programs. Staff who are particularly associated with ECE include:

- Ashley Newton and Rhonda Sherman, human resources functions
- Latesha Zach and Joni Matlock, business support functions
- Norma-Gene Cottrell, professional advisor, dedicated to ECE
- Mallory North, professional advisor, shared with Computer Science

Table 3 Full-time staff

Name	Title	Role
Jeff Birt	ENGINEER I	Machinist and general technical resource
Katie Franks	OFFICE SUPPORT ASSISTANT IV	Secretary to the chair; student hiring
Yuri Go	PROGRAM/PROJECT SUPPRT COOR II	Support for EMC lab
Kevin Hasner	ELECTRONICS TECHNICIAN SR	Technical support for labs
Cherie' Lewis	OFFICE SUPPORT ASSISTANT IV	Graduate advising support
Baomei Ma	COMMUNICATIONS ASSISTANT SR	Departmental marketing and communications
Jerry Tichenor	RESEARCH TECHNICAL SVCS SUPV	Director of technical support for labs
Roger Younger	SUPERVISOR IT	Embedded systems lab director; instructor; resource for embedded systems projects

Yuri Go is fully supported by the EMC lab on soft funds. Jeff Birt is currently split between departmental funding and EMC lab funding.

Facilities

The majority of ECE activities occur in Emerson Elec. Co. Hall, which was first built in 1959 and expanded in 1997. EECH has offices for all ECE faculty and most of the staff, in addition to classrooms, teaching labs, research labs, and a machine shop.

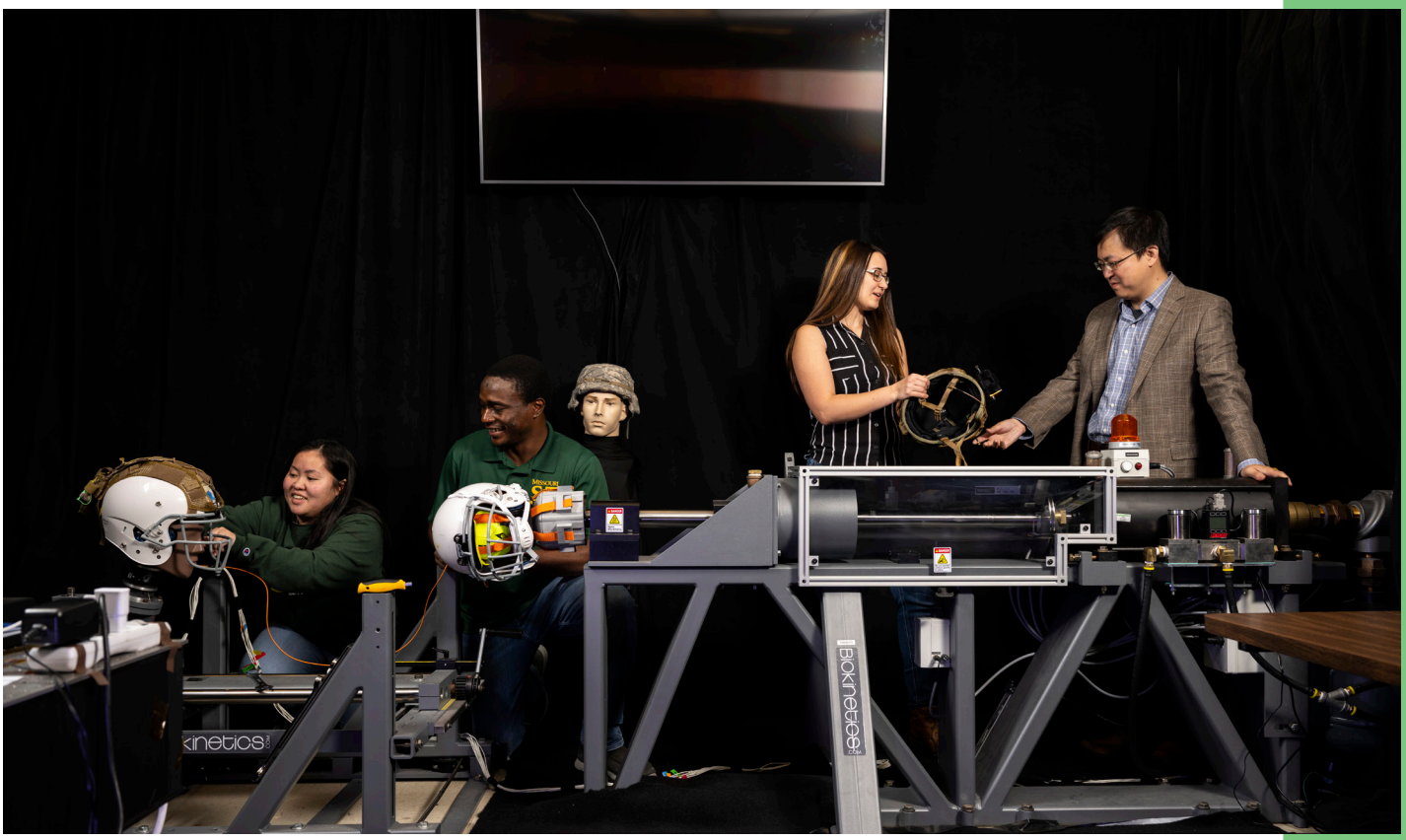
EECH has four regular classrooms with capacities ranging from 43 to 50 students; two smaller classrooms with capacity of 35; one small classroom with capacity of 24, formerly used exclusively for distance classes but now more flexibly allocated; and one large lecture hall with capacity of 184.

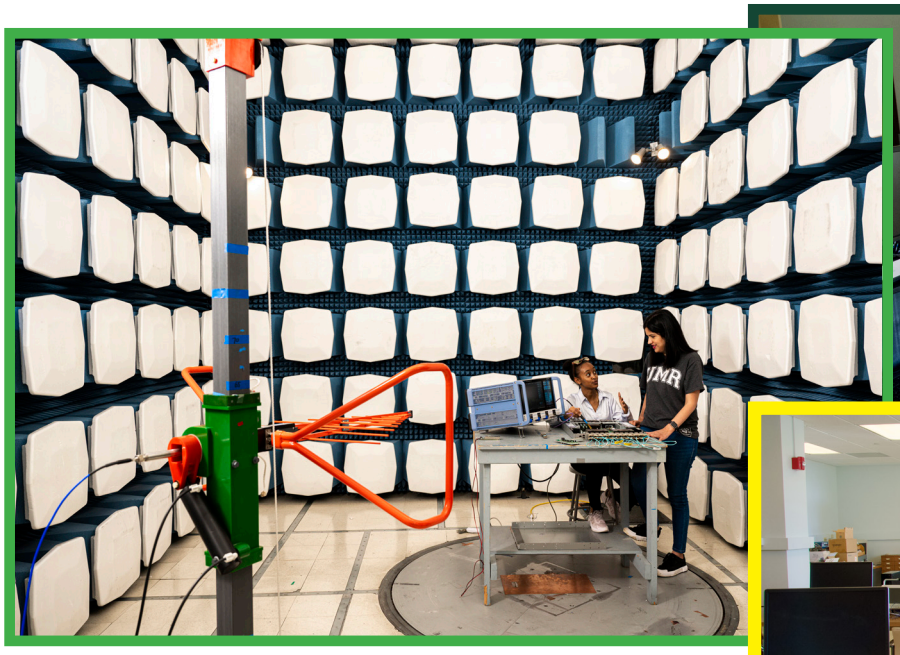
Classes with enrollments slightly larger than 50 are typically moved to classrooms in other buildings, reserving our lecture hall for very large enrollment courses. All classrooms have projectors, and most have microphones and Owls to enhance online learning.

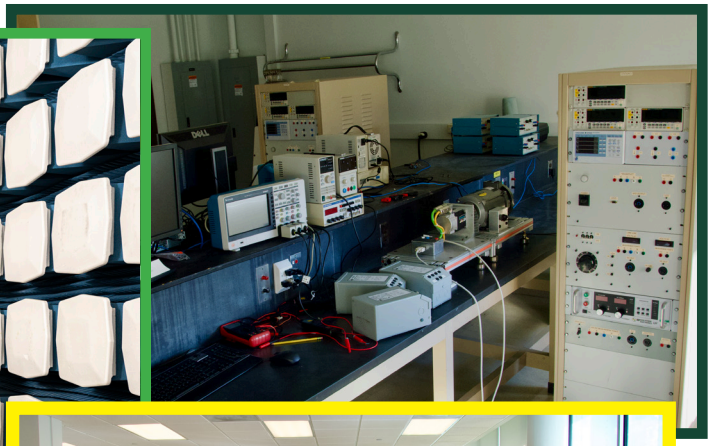
All of the teaching labs used by ECE classes are located in EECH. This includes:

- Two labs that are nearly identical, used for circuits, devices, and electronics labs
- One lab dedicated to introductory computer engineering (digital logic)
- One lab dedicated to controls, communications, and linear systems labs
- One lab dedicated to our embedded systems sequence
- One lab dedicated to power classes (power systems and electromechanics)
- One lab dedicated to factory automation classes
- One lab for senior design, with a variety of equipment to support diverse projects

Additionally, EECH has three computer learning centers (CLCs) that are used for teaching purposes and are otherwise available for general student use.







Several research groups and individual faculty have space allocated in EECH. A section of the newer part of the building has a floating floor that is particularly suited to optics experiments. A section of the older part of the building has extensive trenches and power availability suitable for power electronics and electric machines experiments.

The Electromagnetic Compatibility Laboratory (EMC Lab) outgrew the available space in EECH approximately twelve years ago and relocated to Hy-Point Industrial Park, approximately four miles northeast of campus. Their building is sufficiently large to house two semi-anechoic chambers in addition to a wide variety of other equipment necessary for their research program. There is also a classroom/lecture hall in the building that is occasionally used for advanced graduate courses in EMC, in addition to its use for symposia and research meetings.

The MSU/S&T cooperative engineering program is housed in the Plaster Center near the Missouri State campus in Springfield. In addition to classrooms, the Plaster Center has several laboratories, two of which are dedicated to the electrical engineering program. To the extent possible, the labs in Springfield mirror the labs in Rolla. For the highly popular factory automation courses, the first few weeks of the first course in the sequence involve equipment in Springfield and the remainder of the experiments are performed remotely. This provides the opportunity for students to experience real-world factory automation troubleshooting.

Peer Evaluation Comparisons

Missouri S&T is a public R1 university with a particular focus on engineering. Electrical engineering and computer engineering are ranked 85 and 65, respectively, according to US News & World Report. Several public universities with similar ranking and profiles have been chosen for comparison:

- Auburn University
- Clemson University
- Colorado School of Mines (EE only)
- Georgia Tech (aspirational peer)
- Iowa State University
- Michigan Technological University
- University of Missouri-Columbia
- University of Tennessee-Knoxville

Table 4 provides some comparison data. Student, faculty, and expenditure data were obtained from ASEE, while publication and citation data were obtained from Academic Analytics. Fig.3 indicates the relationship between undergraduate enrollment and research expenditures, normalized to tenure-track faculty count. Some notable observations:

- Most peers have a B.S.-to-TT faculty ratio below 20, whereas S&T has a ratio of 26.2.
- S&T research productivity as measured by Ph.D. degrees per $1M in research expenditures and articles per faculty member are higher than almost all peers. Michigan Tech and Colorado School of Mines have very low expenditures for their graduate population. Only Georgia Tech researchers are more prolific in publishing.
- S&T has a substantially higher percentage of funding from industry (34.4%; only Georgia Tech exceeds 20%). This is driven in part by our world-class electromagnetic compatibility (EMC) group, which is primarily funded by industry.

Figure 3 the relationship between undergraduate enrollment and research

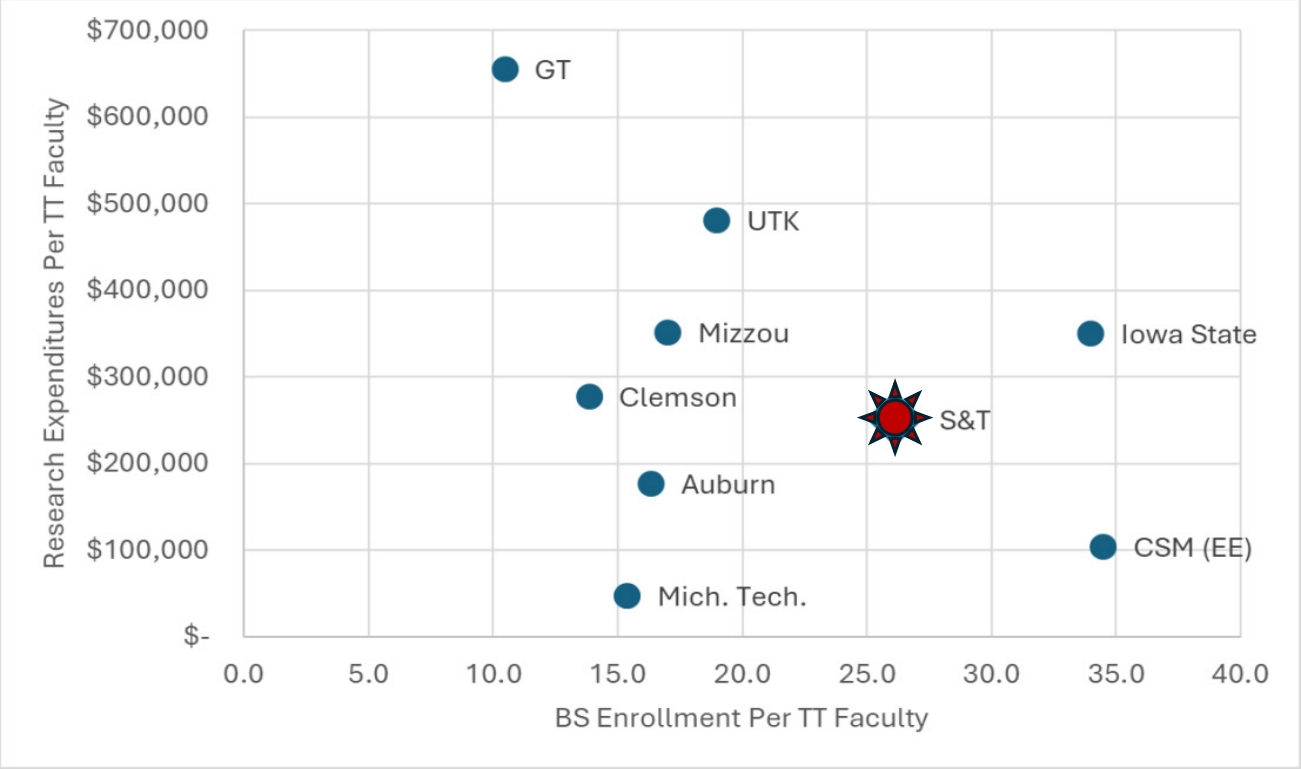


Table 4 ECE Five-Year Average Comparison (2019–2023)

ECE Five Year Average (2019-23)	S&T	Auburn	Clemson	CSM (EE)	Georgia Tech	Iowa State	Mich Tech	Mizzou	UTK
B.S. Enrollment	653.8	474.4	446.0	331.0	1107.2	1617.0	648.7	603	850.6
B.S. Degrees	176.4	105.0	142.6	77.5	331.8	373.6	132.5	218.3	154.6
Total Research Expenditures ($k)	$6,274	$5,120	$8,910	$998	$69,174	$16,641	$2,007	$12,435	$21,517
% of Research from Industry	34.4%	14.9%	2.4%	2.6%	20.8%	11.0%	11.8%	3.2%	7.7%
% of research from Federal Government	61.9%	61.1%	95.1%	73.0%	62.4%	68.1%	83.3%	92.6%	81.9%
Faculty (TT)	25	29	32.2	9.6	105.6	47.6	42.2	35.4	44.8
Faculty (Total)	32	34	41	12.6	180.4	59	55.8	44.4	62
Peer reviewed publications	459	369	324	n/a	2200	462	123	527	n/a
Citations	9525	11062	9362	n/a	69660	13204	2144	16395	n/a
Citations per faculty	27	26	31	n/a	125	48	16	44	n/a
Scholarly Research Index (SRI) Percentile	67.82	67.82	79.21	n/a	91.58	74.26	23.27	67.82	n/a
M.S. Enrollment	29.2	15.2	48.6	18.6	251.2	121.8	70.7	75.3	70.8
M.S. Degrees	28.2	20.6	34.8	18.5	253.8	76.0	55.5	31.8	51.4
Ph.D. Enrollment	66.8	49.6	39.2	16.0	494.0	162.0	11.3	120	159.2
Ph.D. Degrees	13.4	10.4	6.8	6.3	88.8	27.2	11.0	17.8	25.6
B.S. Degrees per Faculty	5.51	3.09	3.48	6.15	1.84	6.33	2.37	4.92	2.49
Ph.D. Degrees per $1M Research	2.14	2.03	0.76	6.31	1.28	1.63	5.48	1.43	1.19
Articles per TT faculty	18.4	12.7	10.1	n/a	20.8	9.7	2.9	14.9	n/a
Total Enrollment per Faculty	23.4	15.9	13.0	29.0	10.3	32.2	13.1	18.0	17.4
Ph.D. enrollment per TT Faculty	2.67	1.71	1.22	1.67	4.68	3.40	0.27	3.39	3.55
Expenditures per TT Faculty	$250,984	$176,576	$276,737	$103,969	$655,062	$349,609	$47,580	$351,278	$480,308

Challenges and Opportunities

Challenges

The ECE Department at S&T faces many challenges to its teaching, research, and service missions, which include:

- The department enrollment has declined for several years, particularly at the graduate level. At the undergraduate level, enrollment has rebounded over the past two years due to our renewed focus on recruitment. However, graduate recruitment remains a challenge. Finding a sufficient number of highly qualified graduate students is essential to maintaining our research productivity.

- At the same time, enrollment in computer science, a companion program, has surged, as has enrollment in mechanical and aerospace engineering. As a result, enrollment in our service courses has surged, straining our resources.

- Computer engineering relies heavily on computer science, which is undergoing curricular restructuring due in part to its changing enrollment and faculty. Changes in computer science directly affect students in our programs.

- Although the total number of faculty in the department has remained essentially stable, there has been significant turnover. Several senior faculty who were highly productive researchers have retired, and several other senior faculty who carry high teaching loads have retired or are planning to retire in the near future. Due to resource constraints, some of these tenured faculty have been replaced with non-tenure track teaching faculty, which may impede our research productivity and graduate programs in the long term.

- Significant growth in research productivity across the university has strained the support structures. For example, the office of sponsored programs is persistently understaffed. Staff who are charged with ensuring compliance with export control and other agency requirements struggle to keep up with growing demands. IT infrastructure is aging.

- Building projects on campus have constrained present space availability. When the projects are completed, it is unclear whether ECE faculty will have access to space they used prior to renovation.

- Gender diversity among ECE faculty is lacking. Currently, among 35 faculty, five are female. Among those, two are NTT teaching faculty, two are tenured associate professors, and one is an untenured assistant professor.

Opportunities

- The department has substantial alumni support in terms of both giving and engagement. In addition to donations and endowments that are specifically targeted for scholarships, the department controls endowments that on average generate $18,871 for general use plus $38,521 for laboratory use, annually. General giving to the department averages $113,457 annually. These flexible funds enable investments in equipment, supplies, and programs. The department also has an active Academy of Electrical and Computer Engineering comprising accomplished alumni with at least twenty years of experience. The Academy meets annually to review the department's programs and to provide support to important initiatives.

- The department can more deeply engage with graduate fellowship programs and recruitment programs across campus, such as the Kummer Doctoral I&E Fellows and the Doctoral Discovery Weekend.

- The campus is continually improving its undergraduate recruitment systems and processes. The department can expand along with those improvements to enhance departmental recruitment.

- The change from Accelerated BS/MS to Grad Track

Pathways (a similar but more flexible program) can be leveraged to increase graduate enrollment. While many of these students will have a minimal impact on our research mission, some may continue for a Ph.D. and all will help us to offer more graduate courses needed for research students.

- As faculty retire, if faculty lines are allocated to the department, the department can be re-shaped to address current research opportunities and teaching needs. A mix of NTT teaching faculty, NTT research faculty, and T/TT faculty in different specialties can target today's technologies, rather than continuing on the same path. Also, ethnic and gender diversity can be enhanced.

- New degree programs can be introduced to reach new students. A semiconductor engineering program is already slated to begin in Fall 2025 and will be supported by a new cleanroom in a building that is currently being renovated. A robotics & automation engineering program is in an advanced stage of development. Interdisciplinary graduate degrees in artificial intelligence are under discussion.

- The cooperative engineering program at MSU has tremendous potential for growth. Although the total MSU enrollment exceeds 25,000, the combined enrollment of all engineering programs is less than 200 (including about 50 in electrical engineering). The program could probably handle double the enrollment without major new investments except in marketing and recruiting.

- The department did not have dedicated marketing resources until 2023. With the addition of a staff member dedicated to marketing, we can more effectively reach diverse audiences—prospective students, peers who submit ranking information, alumni, and industry partners.

- As the campus renews its emphasis on distance learning, the department can support new and existing certificate programs and recruit additional students to strengthen our graduate programs.

Instructional – Teaching and Learning

Degrees Offered

Undergraduate:

- Bachelor of Science in Electrical Engineering with optional emphasis area
  - Circuits and Electronics
  - Communications and Signal Processing
  - Computer Engineering
  - Controls and Systems
  - Electromagnetics
  - Optics and Devices
  - Power and Energy
- Bachelor of Science in Computer Engineering with optional emphasis area
  - Integrated Circuits and Logic Design
  - Computational Intelligence
  - Computer Architecture and Embedded Systems
  - Networking, Security, and Dependability
- Minors and certificates
  - Electrical Engineering Minor
  - Automation Engineering Minor
  - Automation Engineering Certificate
  - Computer Engineering Minor

In addition, dual degree programs are popular, combining computer engineering with either electrical engineering or computer science. Students are provided with example course selections that enable completion of the dual degree in approximately one extra semester.

Graduate:

- Master of Science in Electrical Engineering (with or without thesis)
- Master of Science in Computer Engineering (with or without thesis)
- Doctor of Philosophy in Electrical Engineering
- Doctor of Philosophy in Computer Engineering
- Graduate Certificates
  - Automation Engineering and PLC
  - Electric Machines and Drives
  - Electrical Power Systems Engineering
  - Computational Intelligence
  - Cyber Physical Systems

Description of Program Options

Both B.S. degree programs require a minimum of 128 credit hours with a minimum grade point average of 2.0 overall and 2.0 in all courses in major. Math courses below calculus and basic ROTC courses do not count towards the 128 minimum.

Emphasis Areas for Electrical Engineering

A declared emphasis area is not required. A student may choose to obtain an Electrical Engineering degree without a formal emphasis or may choose to obtain an Electrical Engineering degree with a declared emphasis in one or more of the emphasis areas of electrical engineering. These formal emphasis areas guide the choice of their elective courses. The emphasis area is notated on the degree, e.g., “Bachelor of Science in Electrical Engineering with an Emphasis in Circuits and Electronics.”

Emphasis Areas for Computer Engineering

As for electrical engineering, a declared emphasis area in computer engineering is not required. Prior to Fall 2024, the emphasis areas within computer engineering were provided only to assist in course selection. Effective Fall 2024, students will have the option to declare an emphasis area by taking three 3-credit hour 4000 or 5000 level courses in the desired emphasis area, which satisfies three of the five Senior Elective course requirements. Also, effective Fall 2024, students will be required to take at least one course in two different emphasis areas in satisfying the Senior Elective A-E requirements. The intent with this requirement change is to promote breadth of knowledge.

Undergraduate Minors and Certificates

Students may earn a minor in electrical engineering or computer engineering by completing 18 credit hours of designated coursework. Students may earn a minor in automation engineering by completing 15 credit hours of designated coursework, or a certificate in automation engineering by completing 12 credit hours of designated coursework. The automation engineering program is collaborative with mechanical engineering and chemical engineering programs.

Undergraduate Honors Research Program

A departmental undergraduate honors research option was reviewed and formalized for the 2007 and beyond curriculum. This option allows undergraduates to have an individualized research experience with electrical and computer engineering faculty. It is particularly useful for those students considering graduate school. To be eligible, a student must have junior standing and have a 3.5 GPA or above. The requirements include 2-6 hours of Undergraduate Research CpE/EE 4099 and a graded formal report. The coursework may be applied to the CpE Elective C, D, or E, EE Elective E, or to Free Electives. Upon completion of the program an Honors Scholar in Computer Engineering or Electrical Engineering designation, as appropriate, is added to the student transcript. The program became effective Fall Semester 2011.

Graduate Track Pathway

Accelerated B.S./M.S. programs in Electrical and Computer Engineering were adopted by the ECE faculty and became active in Fall 2018 to promote undergraduate participation in research, pursuit of graduate degrees, and to enhance career opportunities for students. Students who meet the program requirements with Catalog Years Spring 2024 and earlier are eligible to apply for the Accelerated B.S./M.S. program.

After ECE developed the Accelerated B.S./M.S. program, departments across Missouri S&T developed a more comprehensive Graduate Track Pathway (GTP) program. GTP allows the student to complete the graduate program (thesis M.S., non-thesis M.S., or Ph.D.) earlier and at less expense than pursuing each degree sequentially. ECE joined the campus GTP program in 2024. Undergraduate students enrolled at EE or CpE program may opt to apply for the GTP program after completing 60 hours of BS program. There are two GTP tracks: B.S./M.S. track and B.S./Ph.D. track. The final B.S./graduate degrees may be EE/EE, EE/CpE, CpE/CpE, or CpE/EE. Students with Catalog Years Spring 2024 or earlier may apply to the GTP program or the Accelerated B.S./M.S. program. Students with Catalog Years Fall 2024 and later may only apply for the GTP program.

Electrical and Computer Engineering M.S. Programs

The ECE department offers both thesis and non-thesis M.S. programs. M.S. students, both thesis and non-thesis options, may change this degree option and advisors at any time with the consent of their current and new advisors. Once admitted to the M.S. program,

a student will be given six years to complete the program. A student may take a leave of absence, up to one year only, which will not count toward the six-year time limit.

● The thesis option M.S. degree is based on a combination of coursework (21 hours) and research (9 hours). This option requires the student to find a faculty member willing to serve as advisor. This should be done as soon as possible so that the student and advisor will be able to formulate both a plan of coursework (Form I) and a research project. Thesis option M.S. students must have their advisory committee chaired by the student's advisor. The committee must consist of a minimum of three members. The advisor may be from other departments at S&T if a co-advisor from ECE is a member of the student's advisory committee.

● The non-thesis option M.S. degree is based entirely on coursework (30 hours). Non-thesis students are assigned an initial advisor by the department, typically the Graduate Coordinator. In this case the advisor's role is to assist the students in selecting courses consistent with their interests and abilities. The advisor is also responsible for ensuring the student's program of study meets the department's degree requirements and allows the student the opportunity to complete all degree requirements within a reasonable and customary time limit.

Graduate Certificates

Several graduate certificates are available, some of which are collaborative with other departments. Each certificate requires the completion of four graduate-level (5000 or 6000) courses from a designated list.

Electrical and Computer Engineering Ph.D. Programs

The Ph.D. degree requires 90 credit hours (minimum 48 hours coursework and minimum 42 hours research) beyond the B.S. degree or 60 credit hours (minimum 24 hours coursework and minimum 36 hours research) beyond the M.S. degree. The Ph.D. study places a strong emphasis on research with an advisor that is generally conducted on campus. It is strongly recommended for Ph.D. students to have at least three IEEE journal-class articles accepted or under review at the time of the Defense from their Ph.D. work as major contributor. Once admitted to a doctoral program, a student will be given eight years to complete the program. A student may take a leave of absence, up to one year only, which will not count toward the eight-year time limit.

The Ph.D. program requires the completion of a dissertation. Oversight for the dissertation is the responsibility of the student's advisor together with an advisory committee. Doctoral students must have their advisory committee chaired by the student's advisor. The committee must consist of a minimum of five members. The advisor may be from other departments at S&T if a co-advisor from ECE is a member of the student's advisory committee. At least one member from outside the ECE department, but no more than half, is required.

Graduate Program General Eligibility and Application

● The nominal GPA requirement for admission to the M.S. degree program in this department is an undergraduate GPA of 3.3 on a 4.0 GPA system. In evaluating the academic performance from universities that may use other grading systems, the department may rely upon statistical data gathered in analyzing academic outcomes for recent graduate students to the extent that such statistical data is available.

● The ECE department requires ETS-reported GRE scores and recommends the following scores: Q+V≥305, Q≥ 155, A/WR≥ 3.5. This GRE requirement may be waived if the applicant has an undergraduate GPA of 3.5 obtained from the courses offered by the electrical engineering or computer engineering program at Missouri S&T (must be minimum 18 credit hours).

● For international students who are required to provide TOEFL scores. The required score set by the campus is 80 (iBT) or equivalent. Where TOEFL is not

available, an IELTS score of ≥ 6.5, a PTE score of 58, or a Duolingo score of 105 is strictly required.

- Students seeking admission to the Ph.D. program are expected to meet all of the above recommendations and have a graduate GPA of 3.5 or better. All Ph.D. applicants must provide at least three letters of recommendation. Exceptional applicants may apply directly to the Ph.D. program after completing the baccalaureate degree.

- Students applying for graduate studies in this department on the basis of degrees in closely related fields may have additional conditions placed on their admission. These conditions are generally imposed to make sure that students lacking a traditional Computer Engineering degree will have sufficient background to ensure a reasonable chance for academic success.

Distance Learning Options

All graduate programs are available with distance learning options. Applicants who meet the regular qualifications of graduate admission may directly enter a non-thesis M.S. program or, if an advisor is identified, a thesis M.S. program. Admission to a distance Ph.D. is considered on a case-by-case basis.

Applicants who are deficient in some way, relative to the regular admission criteria, may be admitted to a graduate certificate program. For example, someone whose undergraduate GPA is too low but who has extensive experience, or whose undergraduate degree is not in EE or CpE, may be given the opportunity to demonstrate their proficiency at the graduate level. In some cases, the applicant may be required to take remedial coursework at the undergraduate level. Successful completion of the certificate is considered favorably if the student then applies for admission to an M.S. program.

Laboratories and Hands-On Engineering Experiences

Hands-on experience is one of the hallmarks of the electrical and computer engineering programs to provide a broad, rigorous education for developing professional skills and to promote life-long learning. In 2019, the CpE faculty evaluated undergraduate program equipment needs and upgraded CpE undergraduate lab equipment through Phonathon funds, educational discounts through Tektronix and Newark, and hardware and software package donations (totaling nearly $200k and more than $110k provided by the ECE department), including oscilloscopes, network analyzer, signal generator, digital multimeters, logic probes, power supplies, and associated software to modernize the lab experience for students. These upgrades are modernizing the equipment and tools to enhance the experience for undergraduate students and prepare them for the modern workforce. ECE has endowments which provide roughly $35k/year for purchase of laboratory equipment and another endowment which provides roughly $7k/year for support of senior design.

The following are labs used in the undergraduate and graduate programs. The curriculum in the lecture and laboratory courses that use these laboratories are regularly reviewed and revised. Laboratory equipment and software have been periodically updated to provide students with exposure to modern tools and technology.

- Advanced Embedded Systems Laboratory. This laboratory primarily supports the CpE 5151, Digital Systems Design Laboratory, and CpE 5160, Embedded Processor System Design, courses. Both are 3-credit hour courses combining lectures with hands-on learning. The equipment in the Advanced Embedded Systems lab is also available for use by students in CpE5170 and CpE5610 and for CpE 3150 projects. It is occasionally used for CpE 5420, CpE 6420, CpE 6430, CpE 6440, CpE 6510 and by select students in senior design (EE/CpE 4097).

- Digital Systems Design Laboratory. This laboratory primarily supports the courses CpE 2211, Computer

Engineering Laboratory, and CpE 3151, Digital Engineering Lab II.

- Nidec Undergraduate Power Laboratory. This lab supports three courses - EE 3501, Electromechanics Laboratory, EE 3541, Power System Design and Analysis Laboratory, and EE 5521, Power Electronics Lab. The equipment is also available for occasional use by the students in EE 5520, Power Electronics, as well as other power-related courses when needed.

- Factory Automation Lab. The ECE Factory Automation Laboratory supports three regularly scheduled courses – EE 3340 (Basic Prog. Logic Controllers), EE 5340 (Advanced PLC), and EE 5345 (PLC Motion Control) that serve more than 200 students per year. Every semester, the laboratory also supports two to three senior design projects involving PLCs. This laboratory regularly attracts support from industry, including major donations from companies like McEnery Automation, Intelligrated, Automation & Control Concepts, Siemens, Anheuser-Busch, CPM Beta Raven, Nucor, ArcelorMittal, Burns & McDonnell, among others.

Senior Survey Results

In ECE senior survey responses from the academic years 2019-2020 through 2022-2023, students indicated at rates of 86%, 84%, 96%, 98%, respectively, that upon graduation with their B.S. degrees that they were either employed, pursuing further study, not seeking, or continuing existing employment. Undergraduate students have also consistently responded (see Appendix Table - ABET measure results for Outcomes 1-7 from SP21 through SP24 – CpE/EE) that their education has exposed and provided them with an ability to:

- Communicate effectively
- Ethical responsibility
- Use modern tools
- Know contemporary issues
- Engage in life-long learning

In addition, there are several ABET measures from the capstone courses (EE/CpE 4096 and 4097) that students are exposed to and demonstrate proficiency in design- and team-based projects, activities, and experiments.

In their educational opportunities at Missouri S&T, students have a variety of opportunities to participate in hands-on activities, including:

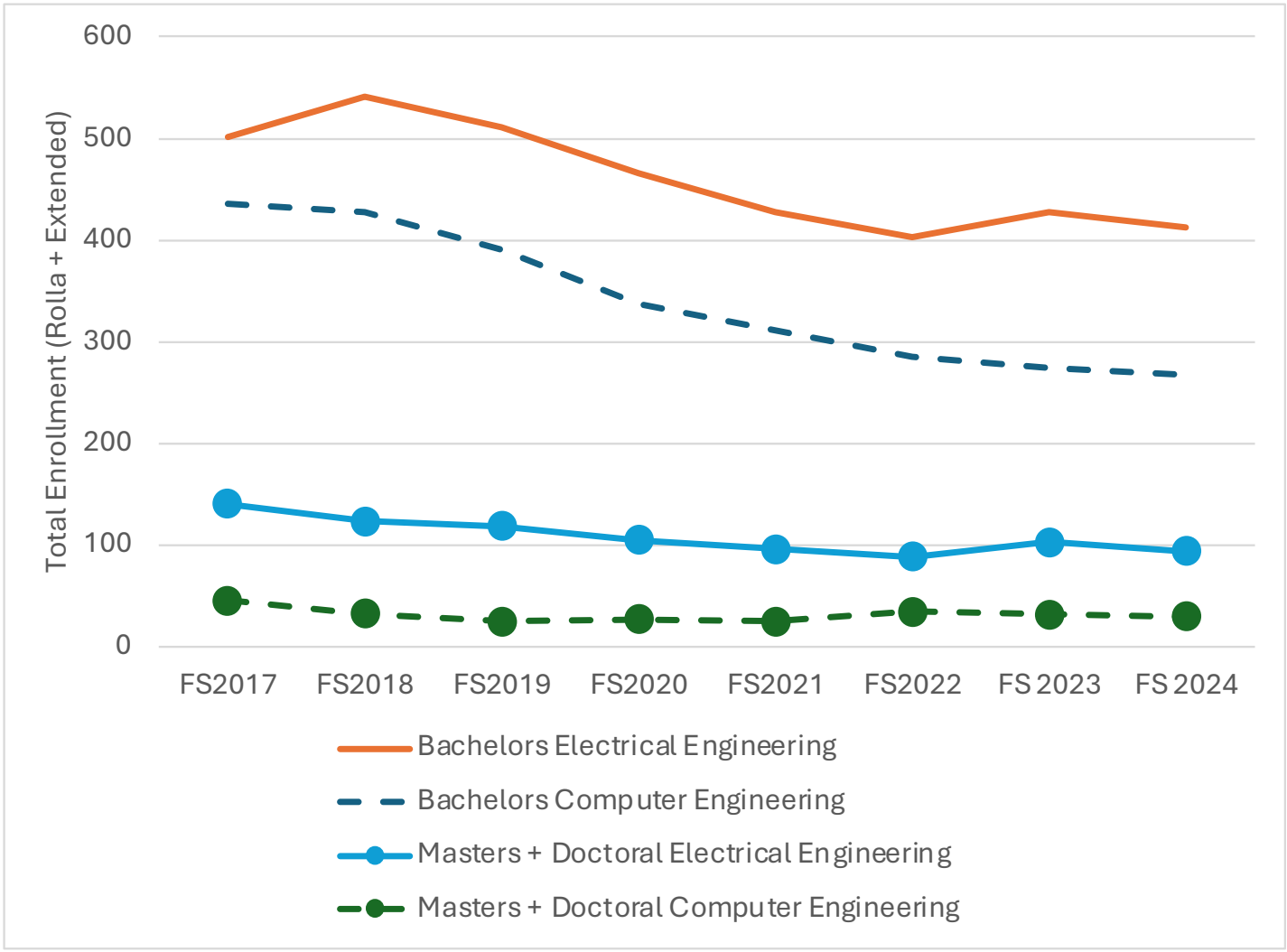
- Eta Kappa Nu Outreach and Competitions (https://hkn.mst.edu/)
- IEEE/ASEE/ACM Outreach and Competitions (https://ece.mst.edu/student-opportunities/)
- Opportunities for Undergraduate Research Experience supported by Missouri S&T (https://experientiallearning.mst.edu/undergraduateresearch/oure/)
- Faculty funded undergraduate research (https://ece.mst.edu/research/)
- Student Design and Experiential Learning Center (19 Different Teams) (https://design.mst.edu/designteams/)
- Kummer Center for STEM Education (https://stemcenter.mst.edu/)
- Missouri S&T Amateur Radio Club (https://w0eee.mst.edu/)

Several of these opportunities are discussed in more detail under “Service and Community Engagement.” Undergraduate research, both through OURE and with faculty funding, often serves as a soft entry point for graduate study via Grad Track Pathways.

Enrollment and Graduation Data

Figure 4 illustrates trends in undergraduate and graduate enrollment since 2017. All data is based on the census taken at the end of week 4 of the fall semester and includes both on-campus students and extended learning (online and MSU).

Figure 4 Trends in ECE Enrollment: Undergraduate and Graduate Data (2017-2024)



New undergraduate students in ECE come from two main sources: first-time college students (FTC) and transfer students (TRE). The stacked bar chart in Fig. 5 illustrates how these two sources contribute to enrollment in the department. The superimposed line indicates the recruitment effectiveness of the department compared to the campus as a whole. In spring 2023, the department established a recruitment committee to organize and centralize our department's efforts, which resulted in a significant change for Fall 2024.

Figure 5 New ECE Student Enrollment Sources (2021-2024)

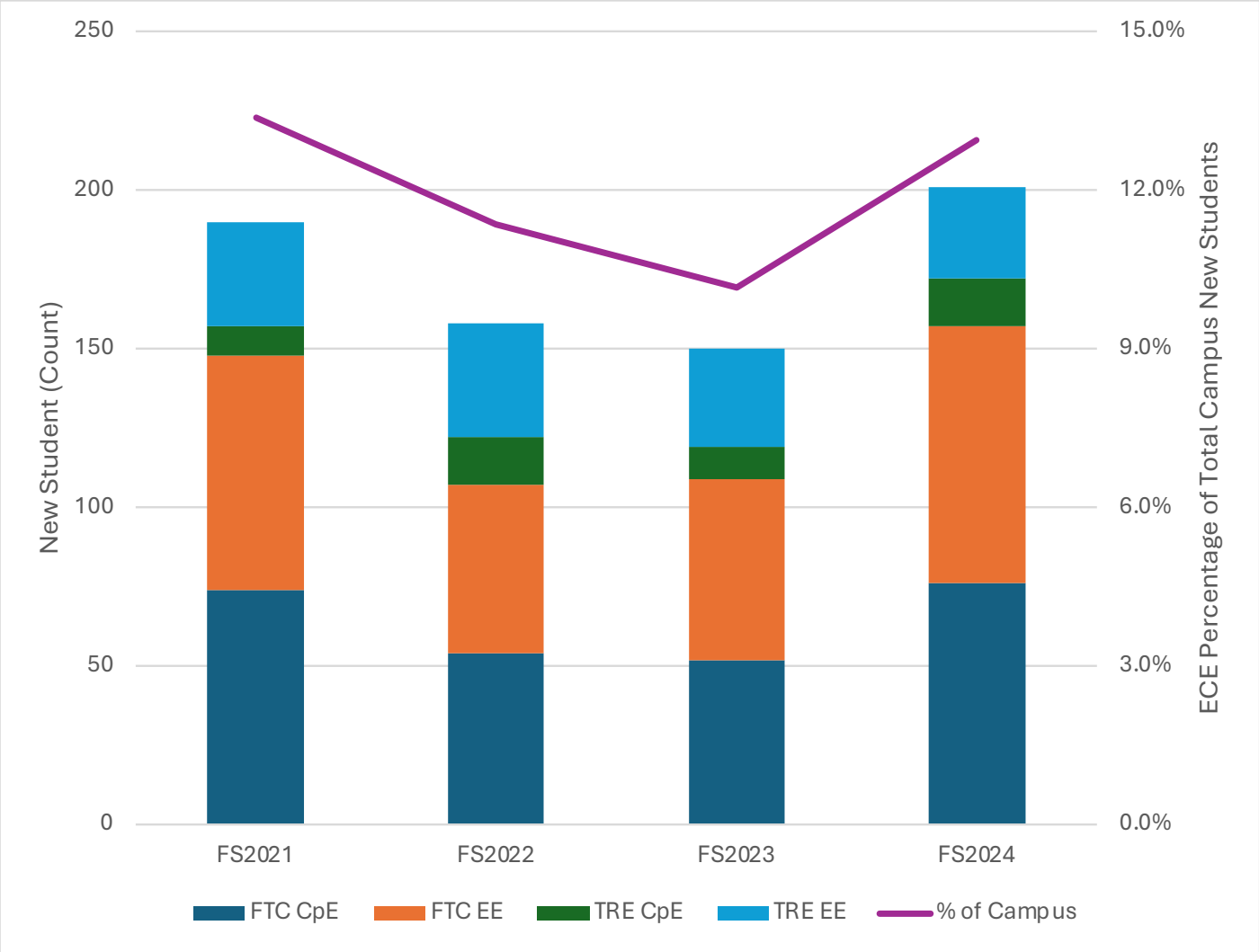
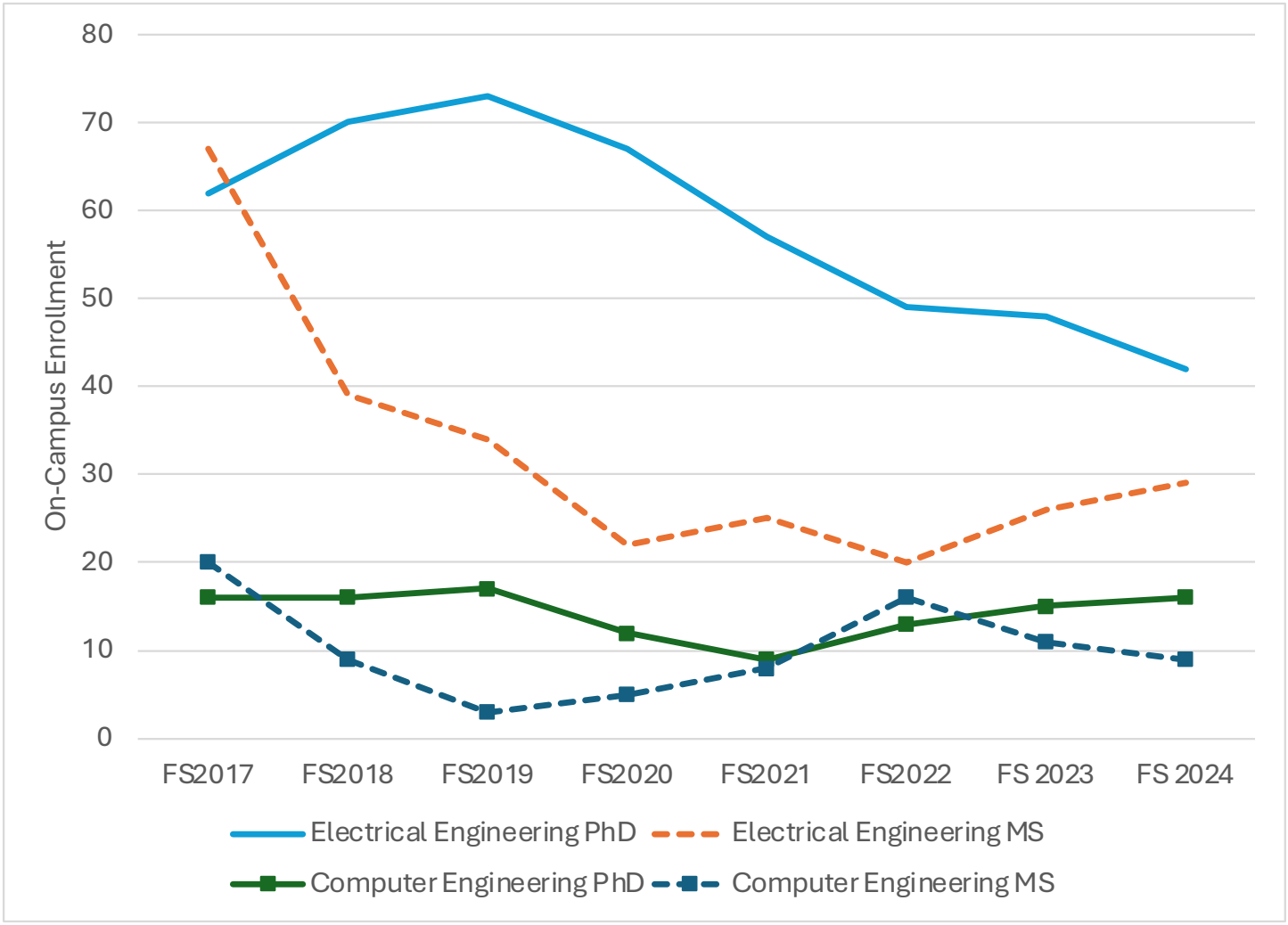


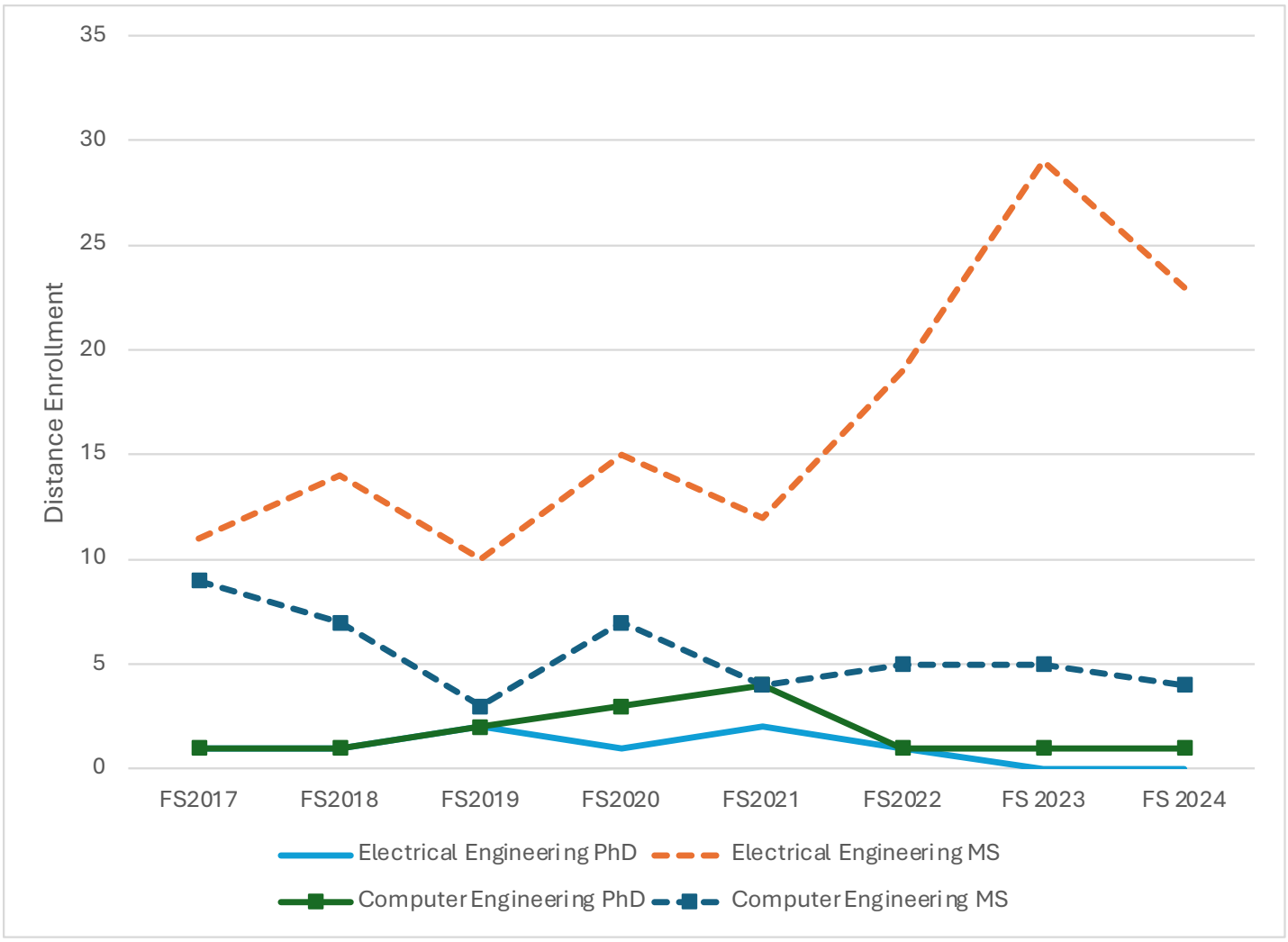
Figure 6 illustrates on-campus graduate enrollment. Although there has been a general decline in enrollment since the department's peak in 2016, EE MS and CpE Ph.D enrollment are rising again. These are presumably driven by our newly emphasized accelerated BS/MS program (now Grad Track Pathways) and a GAANN program in computer engineering.

Figure 6 On-Campus Enrollment Trends for ECE Graduate Programs (2017-2024)



Whereas on-campus enrollment is dominated by Ph.D. students (due to their research activities), distance enrollment is dominated by M.S. students, as illustrated in Fig. 7. The department does not advertise an online Ph.D. but handles each case individually. The fundamental question in each case is whether the student can effectively perform research without visiting campus. They must develop a plan with their advisor that is satisfactory to their committee and the graduate coordinator.

Figure 7 Distance Enrollment Trends for ECE Graduate Programs (2017-2024)



Where enrollment is a leading indicator, degrees awarded are lagging indicators. Figs.8-10 illustrate trends in degrees awarded: BS degrees, graduate degrees, and certificates and minors. As expected, degree awards continued to decline for some time after enrollment began to increase. Given the enrollment trends indicated above, increases in all degree awards are expected in the coming academic years

Figure 8 Trends in BS Degree Awards in ECE (2020-2024)

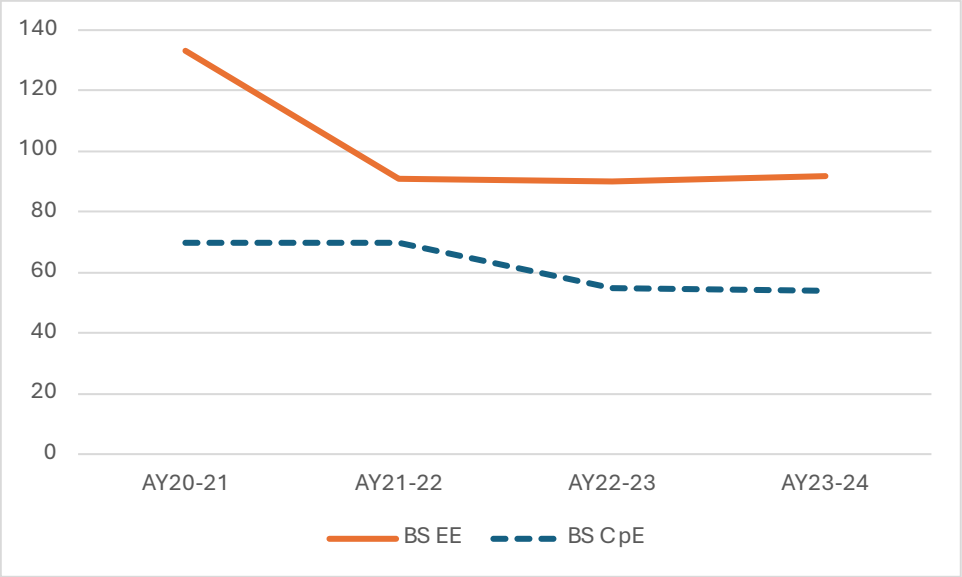


Figure 9 Trends in Graduate Degree Awards in ECE (2020-2024)

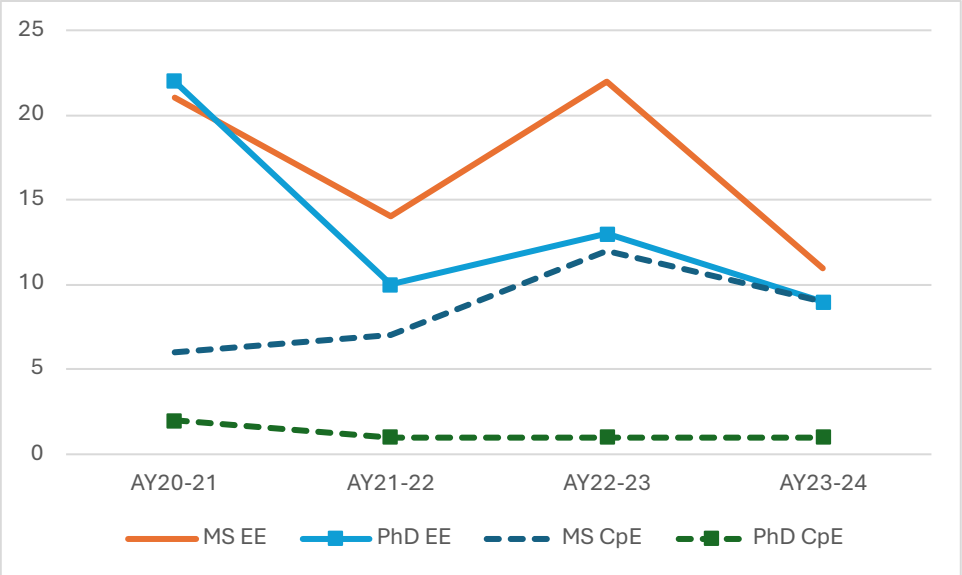
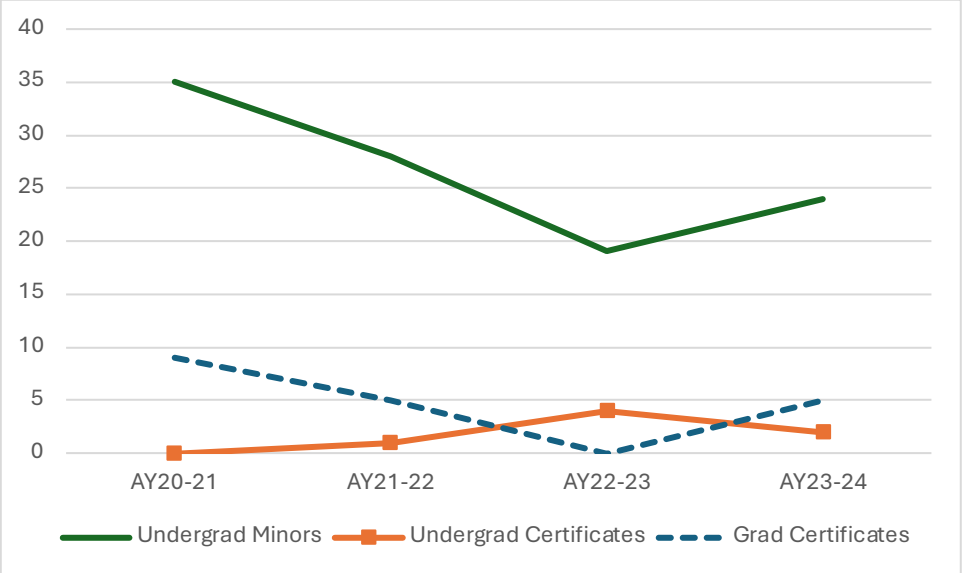


Figure 10 Trends in Certificate and Minor Awards (2020-2024)



ABET Accreditation

The Computer Engineering (CpE) B.S. degree program was proposed in 1997, approved by the Missouri Coordinating Board of Higher Education (CBHE) in 1998, and was initially accredited by ABET in 2002. The last general review was in 2020. No deficiencies, weaknesses, or concerns were found.

The Electrical Engineering (EE) B.S. degree program was established in 1914 as part of the Physics department and became a separate department in 1924, and was initially accredited by ABET in 1936. The last general review was in 2020. A cooperative program with Missouri State University (MSU) in Springfield, Missouri, was established in 2008 and was accredited as part of the Electrical Engineering program in 2012.

In the 2020 ABET evaluation, one concern was identified for the MSU cooperative program related to laboratory equipment. Since then, significant investments have been made and new processes were implemented to ensure that regular maintenance occurs.

See Appendix-CpE and EE Program Changes Since Last ABET Review for a listing of program changes/updates between 2014-2020. The next CpE and EE ABET program review will be in Spring 2026.

Program Educational Objectives

The Electrical and Computer Engineering degree programs seek to prepare its graduates to attain the following accomplishments a few years after graduation:

- Succeed in professional career placement and practice as ethical engineers, scholars, and entrepreneurs;

- Grow their career through technical and professional activities and leadership roles;

- Contribute to society and the economy through technical products, services, communication and knowledge;

- Adapt to an ever-changing world through continued education, through graduate study, professional development activities, independent learning, or pursuit of follow-on degrees.

To attain these objectives, students graduating from the Electrical and Computer Engineering degree programs should have the following attributes:

- Technical Competency. Graduates will have a sound knowledge of the fundamentals in electrical or computer engineering that allows them to analyze and solve technical problems, to apply hardware and software tools, to create and evaluate technical products, to learn independently, and to succeed in the workplace and in graduate school.

- An Engineering Perspective. Graduates will be capable of understanding complex projects and the creative process required to find innovative problem solutions, including project evolution and abstraction and the optimization of associated decisions and risk, both locally and globally.

- Professional Skills and Knowledge. Graduates will have the ability to communicate well in both oral and written form, to interact in teams, to manage and lead technical projects, to manage their career, and to conduct themselves with an understanding of ethics, economics, and intellectual property.

These objectives can be obtained through ABET student outcomes 1-7, adopted by the ECE faculty unanimously in October 2019 (see ECE Department Website at https://ece.mst.edu/mission-objectives-outcomes/) and reaffirmed in March 2024. The student outcomes 1-7 for the EE and CpE BS programs are related to the three Program Educational Objectives (PEOs) as shown in Table 5.

Table 5 Relation of Outcomes 1-7 to Program Educational Objectives

Student Outcomes	Educational Objectives of the EE and CpE BS Programs		
	Technical Competency	Engineering Perspective	Professional Skills and Knowledge
1. (a,e,k) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	X		
2. (c,k) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	X	X	
3. (g) an ability to communicate effectively with a range of audiences			X
4. (f,h,j) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts		X	X
5. (d) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives		X	X
6. (b,k) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	X		
7. (i) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	X		X

More details are provided in Appendix-Outcomes 1-7 with Overview of Measures and Appendix-Student Outcomes with Specific Measures.

Graduate Learning Outcomes

All graduate students are assessed according to a two-page rubric. Thesis-based M.S. students are assessed by their committee when they defend their thesis. Non-thesis-based M.S. students are assessed by the graduate coordinator when they are in their final semester. Ph.D. students are assessed by their committee at both their comprehensive exam and their final defense.

The first page of the rubric asks for a general ranking, on a scale of 1-5 (from unsubstantiated to exceptional), of:

- Knowledge
- Communication
- Critical Thinking
- Professional Development

The second page is provided in Appendix-Graduate Program Rubrics and includes three to five subsidiary rankings on each of these dimensions.

Assessment and Continuous Improvement

Responsibility for assessment collection is shared among the Department Chair, Associate Chair for ECE Academic Affairs, area coordinators, and other faculty and staff. Records are maintained and shared with the Associate Chair for Academic Affairs, EE and CpE Coordinators for Undergraduate Studies, and department staff, and Faculty Minutes are maintained by the Department Chair's Secretary.

Table 6 below shows the timeline over the six-year ABET cycle for data collection, analysis, assessment technique review, and curriculum changes. The most recent ABET accreditation for the Computer Engineering program was completed in 2020. In the assessment timeline given in Table 6, 2021 is the first year of the current ABET cycle.

Table 6 Assessment Timeline

	Year					
Action	1	2	3	4	5	6
Collect data						
Development office feedback						
ECE Academy						
General feedback						
Review mission/objectives						
FE Exam results (optional)						
Grades, selected assignments[1]						
Senior Design I and II						
Senior survey						
Advancement exam grades						
Analyze data (ECE chairs + faculty)						
Mission/objectives						
Outcomes						
Review/revise assessment techniques (ECE chairs + faculty)						
Approve curriculum changes (ECE faculty, ECE academy, S&T curriculum committee)						

1 Circuits I lab (Elec Eng 2101), Computer Engineering lab I (Comp Eng 2211), Introduction to Microcontrollers and Embedded Systems (Comp Eng 3150) (Comp Eng Only), Digital Engineering lab (Comp Eng 3151) (Comp Eng), Electronic Devices (Elec Eng 2200), Electronic Devices lab (Elec Eng 2201), (Elec Eng 3101) (EE Only), (Elec Eng 3501) (EE Only).

Beginning in 2021, the Associate Chair for Electrical and Computer Engineering Academic Affairs was charged with coordinating the collection and assessment of various program measures. The data collection process for the different measures includes the Associate Chair working with the Electrical and Computer Engineering Undergraduate Studies (UG) Committees, chaired by the Coordinators of the EE or CpE UG Studies, the ECE Department Chair, ECE faculty, and the ECE Department staff. In 2015, Bloom's taxonomy-based learning outcome guides were determined for developing and assessing the student outcomes 1-7. For each outcome, desired student abilities were identified, and measures developed to quantify student proficiency in those areas.

The department has a coordinated evaluation of the EE and CpE B.S. programs. The selected measures include feedback from the following:

- Alumni – Academy of Electrical and Computer Engineering meetings and survey

- Student – Graduating senior survey. FE Exam is optional.

- Faculty – Committee evaluation and coordination of Electrical and Computer Engineering courses

Other inputs are considered such as guidelines developed by ABET, ACM, and other faculty/alumni/employer groups. Any proposed revisions to the curriculum are subject to the approval of the ECE Department faculty with review by the Academy of Electrical and Computer Engineering. A formal evaluation is undertaken every three years. The most recent review by the CpE faculty was conducted in February 2024 and by the ECE Faculty as a whole in March 2024.

Much of the assessment data is gathered in courses that are required for one or both majors:

- Comp Eng 2210 Introduction to Digital Logic

- Comp Eng 2211 Computer Engineering Laboratory

- Comp Eng 3150 Introduction to Microcontrollers and Embedded Systems

- Comp Eng 3151 Digital Engineering Lab II (CpE Only)

- Comp Eng/Elec Eng 4096 Senior Project I

- Comp Eng/Elec Eng 4097 Senior Project II

- Elec Eng 2100 Circuits I

- Elec Eng 2101 Circuits I Laboratory

- Elec Eng 2120 Circuits II

- Elec Eng 2200 Electronic Devices

- Elec Eng 2201 Electronic Devices Laboratory

In Comp Eng 2210 and Elec Eng 2100, 2120, and 2200, the final exams are combined across sections and are used as advancement exams. That is, students must earn a C or better on the final exam in order to pass the course. The advancement exams then are used to evaluate program-level success on student outcomes.

Appendix Table - ABET measure results for Outcomes 1-7 from SP21 through SP24 – CpE presents the measure results for CpE program from the data collected every semester from SP21 through SP24 for each outcome (1-7) using the measure guidelines in the columns labeled ABET Standard and Goal.

From the table in the appendix, there are a few observations. Advancement exams results for the overall scores from EE 2100-Circuits I (1.A1/1.E1), EE 2200-Intro to Electronic Devices (1.A3/1.E3); individual

problem scores equivalent circuit problem from EE 2100 (1.E6), op amp problem from EE 2200 (1.E10) gave the most inconsistent results and were the most common measures with median scores below the goal for those measures. There are some semesters where the sophomore-level advancement exam measure targets are not being met for Elec Eng 2100, Elec Eng 2120, Elec Eng 2200, and Comp Eng 2210. There are a number of different faculty members and graduate teaching assistants who teach these courses, so greater coordination among the instructors for these courses will be sought to ensure that the required curriculum is being covered. In Spring 2019, the procedure for putting together questions from the course instructors was updated to promote uniformity of the exams across semesters. The updated procedure is to solicit questions from each instructor of the relevant courses; the EE and CpE undergraduate coordinators review the collected questions for difficulty and topic coverage. The instructors are given the opportunity to review and provide feedback on the questions in producing the final draft of the advancement exams. This process was put into effect for Spring 2019 and undergoes periodic review.

Second, other measures consistently met expected goals, with occasional semester dips below the goal. The EE and CpE faculty review the ABET results every 3 years to assess program outcomes and address corrective actions and program changes to reflect measure disparities and curriculum changes, with the most recent review in March 2024. Program Educational Objectives and student outcomes were approved. ABET data from 2020-2023 was reviewed, noting measure results that did not meet the targeted goals. In particular, there were several semesters with advancement exam scores (total score and individual problems for EE 2100, EE 2120, EE 2200, and CpE 2210) that fluctuated around the targeted goals. In EE 2100, EE 2120, and EE 2200, the individual problem scores used as measures had significant variations from semester-to-semester. Inspecting the ABET data collected for these problems showed that relatively few students completed these problems when taking the advancement exams, leading to widely varying statistical results. Accordingly, a change is being implemented, starting FS24, in the EE 2100, EE 2120, and EE 2200 advancement exam procedures to require all students to complete the targeted ABET individual problems and to allow for students to complete 6 of the remaining 8 problems.

Starting in March 2023, the electrical engineering faculty began restructuring the BS program. First, the need for EE 2200 (Introduction to Electronic Devices) and its accompanying laboratory (EE 2201) was discussed. The need for this course has diminished and alumni were commenting on the lack of a general linear systems course in the curriculum. The faculty concluded that the EE 2200/2201 combination needs to be replaced with a linear systems course and accompanying laboratory. This change in the curriculum was approved in January 2024, to be effective for freshmen entering in Fall 2024. Second, the math sequence was re-arranged to better serve the Circuits I course that needs some background in differential equations for the transient analysis towards the end of the Circuits I course. So, the prerequisite for the Circuits I course was changed to be preceded or accompanied by Differential Equations. The normal mathematics sequence becomes Calculus I – Calculus II – Differential Equations – Calculus III. This change was effective for the Circuits I course in Fall 2024.

Other improvements in the curriculum that are currently underway include:

- Restructuring the networking courses in the CpE program to split the existing CpE 5410 into two courses. The amount of material in the existing course is excessive and impedes student success.

- Updating courses that currently require EE 2200 as a prerequisite to incorporate the necessary material.

- Updating EE 2200 to become a service course for the

CpE program. Some material in the current course will be eliminated to enable more detailed discussion of CMOS.

● As noted above, CpE will now include optional emphasis areas. For students who seek a Computer Engineering degree without a formal emphasis, these emphasis areas may guide the choice of their COMP ENG Electives A, B, C, D, and E as well as their free electives. For students who seek a Computer Engineering degree with a declared emphasis, courses in the declared emphasis area will be applied to COMP ENG Electives A, C, and D in the degree requirements. For students who choose to have multiple emphasis areas, the additional courses will apply to COMP ENG Electives B and E and free elective requirements. As for EE, emphasis areas enable students to deepen their knowledge in a specific area that is notated on their degree.

Laboratory Improvements

Historically, laboratory courses have been coordinated by the faculty member who was teaching the associated lecture course. In some cases, this led to laboratory courses languishing with minimal improvements due to turnover in faculty leadership.

In 2023, each laborator course was assigned a faculty owner, someone who is charged with both supervising the teaching assistants and enhancing the course itself. Over time, the faculty owner is expected to upgrade experiments, identify new equipment or capabilities that are needed, ensure that all documentation is sufficient for the students, and improve the learning experience.

In 2024, we began producing videos to accompany labs. The videos are intended to supplement the lab manual so that students are more able to succeed. We are also producing short videos that introduce the subject of each lab to mitigate issues that arise when the lab runs ahead of the lecture. These videos are resource-intensive to produce, so they will be introduced over time as resources are available.

Lab equipment requires consistent upgrades. Most recently, the Advanced Embedded Systems Lab and the Nidec Undergraduate Power Lab received complete overhauls. In 2024, internal funds and funding from the Academy of ECE were used to replace obsolete equipment in several of the labs. The next major upgrades are needed for the factory automation laboratory and the control systems laboratory, both of which are functional but require enhancements to stay current with available technology in the field.

Advising

Undergraduate

Since 2022, undergraduate students in EE and CpE have been primarily advised by professional (staff) advisors. Previously, each faculty member advised a varying number of undergraduate students whose interests may or may not have been aligned with the faculty member's area of expertise. Now, with the addition of Norma-Gene Cottrell (full-time in ECE) and Mallory North (split between ECE and computer science), staff advisors handle primary advising. Each semester, students meet with their advisor to review progress towards degree and plan for upcoming semesters. The advisors also monitor low-performing students and support their skills development, guiding them towards relevant campus resources.

The staff advisors have broad knowledge of the degree requirements and course sequences and steer students towards relevant faculty for career mentorship. For example, if a student is evaluating internship opportunities or seeking an undergraduate research position, the advisors will help the students identify faculty who are active in the relevant area and facilitate a connection.

The advisors formally report to an advising director within CEC (Erica Long) who ensures that all advisors have the resources, systems, and professional development opportunities that they need to serve students. However, the advisors reside in the department offices so that they are engaged with the life of the department. They serve a critical role in connecting students with events, opportunities, and faculty research programs. Many students visit their advisor regularly to monitor progress and identify problems before they become insurmountable.

Students are admitted to a specific major when they first join S&T. Transfer students meet with on of the departmental staff advisors prior to their arrival to evaluate their academic plan. Freshmen, however, are initially advised through a CEC-managed advising center. In most cases, freshmen are not able to take

courses in major and must adjust to the new expectations of college life. Additionally, many freshmen ultimately decide to pursue a different major than they initially chose. The advising center guides freshmen through all of these challenges. When the student has completed a specific set of courses—calculus, physics, certain humanities—they are then able to take courses in major and are moved to departmental staff advisors.

Graduate

Advising at the graduate level depends on the nature of the program in which the student is enrolled. On-campus MS (thesis) and Ph.D students must have a designated advisor within the department who directs their research. On-campus MS non-thesis students are advised by the graduate program coordinator (currently Chang-Soo Kim). Distance students are all advised by the distance learning coordinator (currently Sahra Sedigh Sarvestani); if the distance student is in a research degree program, the distance learning coordinator focuses on just the distance aspects of the degree program while the primary advisor is a faculty member who directs their research.

The ECE department has been promoting real-world experiential learning through internship (or co-op) activities. To support this initiative more systematically, a dedicated internship course number was established in SP 22. Students are required to submit a final report form before the Final week of each semester (see Appendix-Graduate Program Rubrics). The course description, as currently listed in the catalog, is as follows:

- EE/CpE Internship 5085/6085: Students working toward a master (or doctoral) degree may select, with the advice of their committees, an appropriate internship opportunity as an integral part of the degree program. The internship plan must conform to the purpose of providing a high level engineering experience consistent with the intent of the master degree. This course will explore how well the current graduate curriculum prepares students for tackling the practical problems that they will encounter in the workplace. Assessment may be based upon the Satisfactory/Unsatisfactory grading option depending on the quality of reports and/or presentations summarizing the outcomes of internship activity to the student's academic advisor.

Internship credit does not count towards a degree but provides tracking of student participation and success.

Table 7 presents the number of students who have undertaken internships over the past five years. Typically, the duration of internships is one semester (4 - 7 months, including the summer session) for MS, while Ph.D students generally engage in internships for two semesters (12 months, including the summer session).

Table 7 Number of graduate students undertaking internships over the past five years

Metrics	AY 19 -20	AY 20 -21	AY 21 -22	AY 22 -23	AY 23-24	Total
Number of students	17	23	21	14	13	88

Indicators of Program and Student Success

As an indicator of student and graduate opportunities, Table 8 presents salary information for ECE Experiential Learning and Post-Degree Salaries and Career Options from 2019-2023.

Table 8 Salary information for ECE Experiential Learning and Post-Degree Salaries and Career

	2019-2020	2020-2021	2021-2022	2022-2023
Computer Engineering				
BS Avg Starting Salary	**$73,058 ECE**	**$71,832 ECE**	**$77,510**	**$84,794**
Graduate Avg Starting Salary (MS)	$69,650 ECE	$71,550 ECE	Not Enough Data Collected to Report	$95,333
Graduate Avg Starting Salary (PhD)	$86,750 ECE	$118,950 ECE	Not Enough Data Collected to Report	Not Enough Data Collected to Report
Experiential Learning-Intern/COOP	$21.83 hr/ $3500 monthly ECE	$22.01 hr/ $3500 monthly ECE	$23.90 hr/ $3800 monthly ECE	$24.83 hr/ $3900 monthly ECE
B.S. Degree Career Outcomes*	89% ECE	84% ECE	86%	88%
Electrical Engineering				
BS Avg Starting Salary	$73,058 ECE	$71,832 ECE	$72,822	$77,906
Graduate Avg Starting Salary (MS)	$69,650 ECE	$71,550 ECE	$106,400	$80,000
Graduate Avg Starting Salary (PhD)	$86,750 ECE	$118,950 ECE	$123,750	$170,000
Experiential Learning-Intern/COOP	$21.83 hr/ $3500 monthly ECE	$22.01 hr/ $3500 monthly ECE	$23.90 hr/ $3800 monthly ECE	$24.83 hr/ $3900 monthly ECE
B.S. Degree Career Outcomes	89% ECE	84% ECE	96%	98%

*Either employed, pursuing further study, not seeking, or continuing existing employment

Supporting Our Students

Our success relies on providing adequate support to students from all backgrounds. Missouri S&T as a whole and ECE in particular need to do more to support female students. Undergraduate enrollment information in Table 9 indicates that ECE female participation is around 11%, while nearly 20% of S&T undergraduates are female. However, nationally, about 22% of engineering BS degrees are awarded to women, including 20.4% in electrical engineering and 15.7% in computer engineering in 2022. This persistent achievement gap indicates that we need to ensure that female students receive as much support as male students and is related in part to the gender gap among faculty. In 2023, Missouri S&T was awarded an NSF ADVANCE grant to enhance institutional climate and promote leadership practices to improve the representation, retention, and advancement of faculty who are women and/or members of underrepresented racial-ethnic groups at Missouri S&T. According to an analysis of S&T faculty vs. ASEE data, the ECE department's female faculty participation rate is on par with national averages, but the tenured/tenure-track faculty participation rate is low.

Table 9 Undergraduate female participation rates

	FS2020	FS2021	FS2022	FS2023	FS2024
ECE BS Total	744	697	654	653	695
ECE BS Female	72	72	72	67	76
% ECE Female	9.68%	10.33%	11.01%	10.26%	10.94%
% S&T Female	19.64%	19.68%	19.66%	19.49%	19.23%

In an effort to improve female achievement, the ECE department supports SWE activities that are related to ECE, just as we support other student organizations. As noted in the section on Service and Community Engagement, the department provides funding for ECE students who attend the SWE national conference. The department also provides funding in support of SWE on-campus events, and faculty often participate to lead hands-on ECE activities.

Similarly, ECE supports NSBE and SHPE, both their local activities and travel to regional and national events. We include all academic-oriented student organizations that serve ECE students to ensure that every student finds a community to support them through their academic career.

Research, Scholarship, and Creativity(RSC)

The Electrical and Computer Engineering (ECE) department is committed to securing additional research funding to enhance our research and scholarship initiatives. Over the past five years, the ECE department has successfully improved key metrics related to research and scholarship. This progress, in turn, supports the financial assistance provided to graduate students through Graduate Research Assistantships (GRA) and Graduate Teaching Assistantships (GTA).

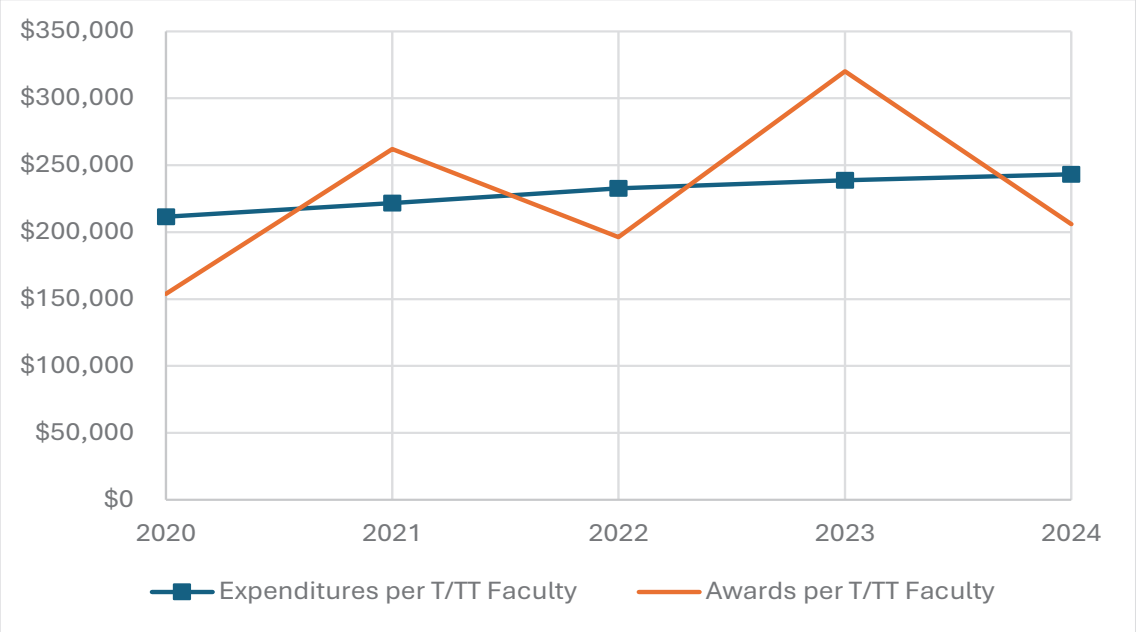
Table 10 reports financial aspects of research productivity, also illustrated in Fig. 11 on a normalized basis. Expenditures per T/TT faculty member have been continually increasing. The fiscal year runs July 1 to June 30.

Table 10 Research awards and expenditures on a fiscal year basis

Metrics	2020	2021	2022	2023	2024
Research expenditures	$5,287,661	$5,541,049	$5,820,255	$6,207,791	$6,080,761
Research Awards	$3,847,135	$6,552,399	$4,907,509	$8,324,434	$5,148,288
Number of T/TT Faculty	25	25	25	26	25
Expenditures per T/TT Faculty	$211,506	$221,642	$232,810	$238,761	$243,230
Awards per T/TT Faculty	$153,885	$262,096	$196,300	$320,171	$205,932

Source: S&T Office of Sponsored Programs

Figure 11 Trends in Research Expenditures and Awards per T/TT Faculty (2020-2024)



GRA and GTA support

Financial support from the GRA (graduate research assistant) and GTA (graduate teaching assistant) mechanisms is a crucial factor in fostering the academic success of graduate students. Table 11 presents the counts of supported GRAs and GTAs and their percentages of the total enrolled students over the past five years. All Ph.D students have been supported primarily through a 12-month/50% FTE GRA, while the GRA support for thesis option MS students is typically 9-month/25% FTE. This preference over Ph.Ds is largely due to faculty members favoring the recruitment of Ph.D students with more extensive research experience. The GTA positions, typically serving as teaching assistants for undergraduate laboratory classes, are offered to either Ph.D or MS students depending on the availability. The ratio of graduate support (GRA and GTA) exhibits a consistent trend that parallels the declining ratio of Ph.D to MS enrollments.

Table 11 Total counts of GRAs/GTAs and the percentages relative to total enrolled students during the past 5 years

	FS 20	FS 21	FS 22	FS 23	FS 24
GRA number (percentage*)	63 (60%)	52 (51%)	55 (55%)	56 (56%)	47 (49%)
GTA number (percentage*)	14 (13%)	16 (16%)	17 (17%)	15 (15%)	12 (13%)
Total GRA/GTA number (percentage*)	77 (73%)	68 (67%)	72 (72%)	71 (71%)	59 (62%)

* Percentage of GRA/GTA support vs.

Scholarly Productivity

ECE faculty are highly productive scholars. The majority of faculty are in fields that prioritize journal articles, though some segments of computer engineering highly value conference papers. A few faculty have also authored books or book chapters, including a series of textbooks on factory automation. The data provided here is self-reported by faculty and differs from the Academic Analytics data for two reasons: publishing in venues that are not adequately tracked and publications with multiple faculty authors.

Table 12 Scholarly output on a calendar year basis

Metrics	2020	2021	2022	2023	2024
Journal Articles	98	121	87	143	94
Conference Papers	106	84	83	125	114
Books	2	2	4	4	1
Book chapters	3	5	5	5	0
Patents Issued	3	3	1	4	0
Products Per T/TT Faculty	8.48	8.60	7.20	10.81	8.32
Citations			6,167	7,295	10,664

Source: ECE faculty annual reports; citation data from Academic Analytics.

Notably, among 35 total and 21 tenured faculty, ECE has 5 IEEE Fellows: **Daryl Beetner, Mehdi Ferdowsi (new in 2025), Lijun Jiang, Jagannathan Sarangapani, and Donald Wunsch.**

Additionally, **Kelvin Erickson is recognized as an ISA Fellow, Rui Bo as an IET Fellow, Lijun Jiang as an ACES Fellow, and Steve Watkins as an SPIE Fellow**.

In 2024, seven current faculty were recognized as among the top 2% cited scientists in their field (according to a Stanford University study) and one, Jie Huang, was listed by Scopus as the most prolific contributor to his field.

Dr. Mehdi Ferdowsi

Comparison to Peer Programs

For a detailed comparison, please refer to the section titled "Peer Evaluation Comparison" found on page 08." Some notable differences between S&T and our peers include:

- S&T has substantially larger industry funding percentage than all peers. This is driven in part by our world-class electromagnetic compatibility laboratory.

- S&T has significantly higher student-to-faculty ratio than most peers.

- Two institutions have been included that have historical backgrounds similar to ours, Colorado School of Mines and Michigan Tech. However, the data clearly indicate that in ECE, both of those institutions are more teaching-focused and less research-focused than S&T.

- Georgia Tech has been included as an aspirational peer. Most notably, the BS student per TT faculty at S&T is 2.5X higher than at Georgia Tech. This enables Georgia Tech to achieve much higher research expenditures and graduate enrollment per TT faculty.

Setting aside Georgia Tech, data has been gathered for seven peers plus S&T. Among these, S&T performance is in the middle of the pack. However, USN&WR rankings do not accurately reflect performance. For example, S&T has higher M.S. and Ph.D. enrollment, more M.S. and Ph.D. degrees awarded, and more publications per TT faculty than both Auburn and Clemson with much higher student-to-faculty ratio and similar faculty size yet has identical ranking in computer engineering and lower ranking in electrical engineering. This might be explained by name recognition, perhaps driven by Division I sports programs.

Alignment Between Department, College, and University Research Initiatives

The ECE department currently organizes faculty according to the ten undergraduate program emphasis areas. To enhance research productivity, the department is in the process of reorganizing around six research clusters. The primary objective of this initiative is to systematically concentrate our diverse expertise in order to identify signature areas of ECE as a whole combining two graduate programs (EE and CpE) for pursuing large-scale, team-based research grants or establishing centers based on collaborative activities. Additionally, this reorganization will enable the department's research direction to align more effectively with that of the College of Engineering and Computing (CEC) and the broader campus community, particularly with the four centers of the Kummer Institute. Table 13 gives the six research areas and their connections to the strategic directions of the CEC and the Kummer Institute. Additionally, Table 14 provides a list of faculty members' expertise in each area.

Table13 Six ECE research clusters and their relationships with the focus areas of CEC and Kummer Institute

	Focus areas of CEC or KI	ECE research clusters					
		Controls & Intelligence	Communi-cations & Networking	Devices & Integrated Circuits	Power and Energy	System Architecture	Waves and Optics
College of Engineering and Computing	Advanced Manufacturing	v		v		v	v
	AI and Autonomous Systems	v	v	v	v		
	Bio-X	v		v		v	v
	Extreme Environments					v	v
	Resilient Infrastructure	v	v	v	v		
	Resource Sustainability					v	v
Centers of Kummer Institute	Advanced Manufacturing	v				v	v
	Advanced and Resilient Infrastructure	v	v	v	v		
	AI and Autonomous Systems	v	v	v	v		
	Resource Sustainability					v	v

Table 14 Faculty expertise in the six research clusters

ECE research cluster	ECE faculty members (primary area)
Intelligence and controls	Levent Acar, Kelvin Erickson, Mohamed Nafea, Jag Sarangapani, Joe Stanley, Donald Wunsch
Communications and Network	Ahmad Alsharoa,Sahra Sedigh Sarvestani, Maciej Zawodniok
Solid-state devices	Kim Chang-Soo
Power and Energy	Rui Bo,Mdhdi Ferdowsi, Jonathan Kimball, Pourya Shamsi
System Architecture and VLSI	Minsu Choi, Ali Hurson
EM and Optics	Daryl Beetner, Kristen Donnell, Mina Esmaeelpour,Jie Huang, Chulsoon Hwang, Lijun Jiang, DongHyum Kim, Steve E. Watkins

Efforts to Increase Research, Scholarship, and Creativity

Faculty in ECE are encouraged to take advantage of opportunities campus-wide, such as the initiatives within CEC or research centers. Formation into research clusters, as described above, will enhance the department's ability to engage with these broader efforts.

Within the department, three main efforts are expected to enhance research and scholarly productivity.

- Growth in non-tenure-track faculty. Since 2009, several NTT teaching faculty have been added to the department. Currently, the department has five teaching faculty with another expected to join in summer 2025. Collectively, the teaching faculty cover most of the classes in the MSU program, a sizable portion of sophomore and junior level courses, our service course (circuits for non-majors), and parts of senior design. This enables tenured and tenure-track faculty to offer courses at the senior and graduate level for the good of their research programs, while remaining engaged with sophomore and junior level courses. At the same time, there has been significant growth in NTT research faculty, increasing from one in 2022 to five in 2024. NTT research faculty add stability to a res earch program and enable tenure-track faculty to pursue more ambitious projects.

- Faculty evaluation structure. While NTT faculty are evaluated only on their respective roles, tenure-track faculty are evaluated on teaching, research, and service, traditionally apportioned 40%/40%/20%. In the past few years, individual faculty have had their workloads adjusted to reflect their actual productivity, with annual evaluations to match. That is, one faculty member may be 65%/15%/20% and evaluated primarily on their contribution to the teaching mission, while another may be 25%/55%/20% and evaluated primarily on their research contributions. In this way, every faculty member may focus (and be rewarded) on their strengths while being engaged across all three aspects of the department's mission.

- An evolving workload model. In 2017, a workload model was instituted college-wide to determine the apportionment indicated in bullet #2. In 2024, the model was updated as indicated in Table 15. The workload model primarily uses research expenditures to determine the relative percentage of research and teaching effort for T/TT faculty. This table is a part of a longer document that acknowledges the diverse scholarly contributions and efforts that are not captured in expenditures, as well as the many factors that must be considered to evaluate teaching load. However, the basic principle remains: faculty who do more research should teach less, and vice versa.

Table 15 T/TT Faculty workload model

Three-year average research expenditures	Research load	Annual course load with 20% service	Annual course load with 33% service
> $500,000	55%	2	1
> $250,000	40%	3	2
>$150,000	30%	4	3
>$80,000	15%	5	4
>$10,000	10%	6	5
0 to $10,000	0%	7	6

Service and Community Engagement

Faculty, staff, and students in ECE are deeply engaged in the life of the campus and our larger profession. The department supports several of these activities directly and facilitates others.

Student Organizations

The Gamma Theta chapter of Eta Kappa Nu (HKN) was established in 1952 and has a long history of excellence. The chapter has received an Outstanding Chapter award 26 times, including five of the last six years (missing only the pandemic year). Our chapter typically sends the most students to HKN's annual Student Leadership Conference and is well represented in HKN leadership. For example, one of our students, Elanor Jackson, was a student governor in 2023, and one of our alumni, Dr. Ryan Bales, is the current president. Two of our alumni are Eminent Members of HKN: Dr. Sandra Magnus, elevated in 2023, and Dr. Mervin Kelly, elevated in 1954. Gamma Theta inducted 31 members in AY23-24 to continue the tradition of excellence.

The IEEE student chapter at Missouri S&T currently has a membership of 152 students primarily from computer and electrical engineering, with some members from computer science. Our branch is dedicated to fostering professional and technical growth through various activities and services. These include organizing company talks, where representatives share insights about their organizations and career opportunities, and hosting hands-on workshops that cover essential skills such as soldering and transistor basics. Additionally, we offer study hours to help students prepare for exams and succeed academically. Our chapter strives to provide valuable resources and opportunities for our members to excel in their fields.

The ECE department hosts W0EEE, the S&T Amateur Radio Club. The club station is equipped with three permanent operating installations, each equipped with transceivers and amplifiers. The antenna array, which includes antennas on top of Emerson Electric Company Hall and Thomas Jefferson Hall, includes 6 VHF and UHF antennas, optimized for local communication, and 6 HF antennas, optimized for long-distance communication. The club currently includes 17 active student members and 2 advisors. In 2024, their team of 13 volunteer examiners held 24 license exam sessions, during which 149 exams were administered to 54 applicants (students and local community members) seeking new and/or upgraded licenses.

The ECE department also supports several interdisciplinary organizations:

- National Society of Black Engineers
- Society of Hispanic Professional Engineers
- Society of Women Engineers

These organizations often organize recruitment events for high school students. The ECE department sponsors activities within those events to provide hands-on electrical or computer engineering experiences. Also, when these organizations attend regional or national gatherings, the department provides funding to all ECE students so that they can receive critical professional development.

Department

The faculty of the department are actively involved in its operations. Five coordinators provide essential support of major operations and are compensated with a course release (that is, their service workload is 33%) and one month of summer salary:

- EE Undergraduate Coordinator, currently Kelvin Erickson
- CpE Undergraduate Coordinator, currently R. Joe Stanley
- Laboratory Coordinator, currently Theresa Swift
- Graduate Coordinator, currently Chang-Soo Kim
- Distance Learning Coordinator, currently Sahra Sedigh Sarvestani

The department has two associate chairs. The role of associate chair for academic affairs rotates between the EE and CpE undergraduate coordinators. The role of associate chair for research is designated for the graduate coordinator.

The department has several committees that are illustrated in Figure 1.

- The Promotion & Tenure committee includes all tenured full professors in the department. For NTT promotion cases, an ad hoc committee is formed to include an NTT faculty member at a rank equal to or above the proposed new rank.
- The Lab Development committee, chaired by the laboratory coordinator, comprises all lab faculty "owners." As noted elsewhere, each laboratory course has an assigned faculty member who addresses issues with experiments or equipment (from a pedagogical standpoint). The committee coordinates these activities to ensure balance among all courses.
- The Recruitment committee coordinates the various activities aimed at incoming freshmen, other high school students, and potential graduate students.
- The Graduate Studies committee, chaired by the Associate Chair for Research, addresses programmatic concerns, such as new degrees and requirements.
- The Computer Engineering Undergraduate Studies committee, chaired by the CpE undergraduate coordinator, and the Electrical Engineering Undergraduate Studies committee, chaired by the EE undergraduate coordinator, address curriculum changes in their respective programs.
- The Teaching committee supplements teaching improvement efforts at the campus level. Whereas campus efforts address general pedagogical issues, the department teaching committee focuses on course content and disciplinary expectations.
- The Scholarship committee sets standards and processes that its chair uses to award scholarships that are under departmental control.

- The Senior Design committee addresses programmatic issues in the two-semester capstone design sequence, including items like external sponsorship and course expectations.

- The Executive committee, comprising the five coordinators, the MSU program director, and a selection of other faculty to provide breadth and balance, provides guidance to the chair.

Most undergraduate advising is provided by professional advisors, currently Norma-Gene Cottrell and Mallory North. This is a relatively recent change in operating practices (since summer 2022), so some students still have faculty advisors. However, this shift in roles, described in on page 28, is expected to improve academic performance, retention, and graduation rates in the long run as students receive more focused advising from dedicated experts.

College and Campus

Several ECE faculty have significant service roles outside of the department that include teaching reduction and/or summer salary.

- Chang-Soo Kim is a faculty fellow in the office of graduate studies.

- Pourya Shamsi is a faculty fellow in the office of sponsored programs.

- Kristen Donnell is the interim director of the Center for Infrastructure Engineering Studies.

- Mehdi Ferdowsi is the associate dean of research for CEC.

- Theresa Odun-Ayo is the director of the MSU/S&T cooperative engineering program.

- Don Wunsch is the director of the Kummer Institute Center for Artificial Intelligence and Autonomous Systems.

- Sahra Sedigh Sarvestani is the faculty ombuds.

Aside from these compensated roles, many ECE faculty hold important positions in faculty governance. For example, Daryl Beetner serves on the S&T research and technology commercialization committee and the campus research leadership council. Jie Huang serves on the Kummer Institute advisory council. Joe Stanley serves on the campus pre-med advisory committee. Several faculty are on college- or campus-level search committees. In these and myriad other ways, ECE faculty contribute to the advancement of our college and university.

Engagement With Our Profession

As home to several world-class researchers, our department has many faculty who are leaders in their technical societies. Just a few examples are provided here:

Daryl Beetner is on the IEEE EMC Society Board of Governors and the IEEE Medal for Environment and Safety committee (recently as Chair). The Board of Governors is an elected position which oversees all of the activities of EMC Society internationally. The IEEE Medal is the most prestigious award bestowed by IEEE. As Chair of this committee, for example, he helped to recognize the inventors of the Neodymium permanent magnet responsible for high-efficiency motors and generators and the inventors of the superjunction transistor which enabled more efficient power supplies that are estimated to have saved more than 3 trillion kWh of energy worldwide.

Kristen Donnell is on the administrative committee of the IEEE Instrumentation & Measurement Society and currently serves as its VP of Finance and Chair of the Society's Distinguished Lecturer Program. She has also held positions of VP of the Membership and VP Education committees in the past. She has been a long-time contributor to the Society's DEI efforts which earned the Society the inaugural IEEE Technical Activities Board Award for Society/Council Impact in DEI in 2022. Her continued support and engagement with the I&M Society also earned her the 2023 Society Distinguished Service Award.

Kelvin Erickson is a Fellow of the International Society of Automation (ISA) and has served ISA in various capacities. He has served on the leadership team for the Education and Research Division, as Director, Asst. Director, and Secretary since its founding in 2010. He has been the Chair of the Student Guardian Committee since 2023 and has served on the ISA Scholarship Committee that selects student scholarships and the ISA Admissions Committee, which selects those worthy of Fellow designation. He also represents ISA to the Accreditation Board for Engineering and Technology (ABET). He has been an evaluator since 2019 and has served as a commissioner for the Engineering Technology Accreditation Commission (ETAC) since 2021.

Ali Hurson served as Editorial Board member of IEEE Computer Society, Editorial Board member of IEEE Transactions on Computers, IEEE Distinguished Speaker, and ACM Distinguished Lecturer. Currently he is a member of the IEEE Technical Committee on Parallel Processing (TCPP), Co-founder/Steering Committee member/Member of Advisory Board of several IEEE conferences including International Conference on Parallel Processing and Distributed Processing (IPDPS), International Conference on Pervasive Computing and Communication (PerCom), International Green and Sustainable Computing Conference (IGSC), IEEE Computer Society Signature Conference on Computers, Software and Applications (COMPSAC). He is the Editor-in-Chief of the Journal of Sustainable Computing, Book Serial editor of Advances in Computers, and an ABET Program Evaluator.

Steve E. Watkins is active in the educational work of IEEE and ASEE. He is a former vice-president of the IEEE Education Society and is co-chair of the editorial board for its Teaching Excellence Hub. He is a former president and magazine Editor-in-Chief for the IEEE honor society, IEEE-Eta Kappa Nu. Among his current volunteer roles, he serves on the editorial board for IEEE-HKN, on the EPICS in IEEE committee of the IEEE Education Activities Board, and as the annual coordinator of the IEEE Region 5 Student Ethics Competition. He received the IEEE-HKN Distinguished Serve Award, the ASEE ECE Division Meritorious Service Award, and the Region 5 John Meredith Lifetime Achievement Award.

Many other faculty are active in IEEE, ASEE, and SPIE conferences, publications, and technical and educational activities. ECE at S&T is committed to the present and future of our profession.

Faculty Profiles

Dr. Levent Acar

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Biography

Dr. Levent Acar is Associate Professor in the department of Electrical and Computer Engineering at Missouri University of Science and Technology. He received B.S. degrees in Mathematics and in Electrical Engineering from Bogazici University and M.S. and Ph.D. in Electrical Engineering from Ohio State University.

Research Interests

Intelligent control of functional systems; Neural networks applied to control; Hierarchical design and control of large-scale systems; Optimal and suboptimal control for interconnected systems; Distributed computational methods of optimal control strategies

Education

- PhD in Electrical Engineering, The Ohio State University
- MS in Electrical Engineering, The Ohio State University
- BS in Electrical Engineering, Boğaziçi University
- BS in Mathematics, Boğaziçi University

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Biography

Dr. Alsharoa obtained his Ph.D. degree in Electrical and Computer Engineering from Iowa State University. Currently, he is an assistant professor at the Missouri University of Science and Technology (Missouri S&T), USA. He is also the founder of the “Optimization and Intelligent Wireless Systems Laboratory (OIWS LAB): https://sites.mst.edu/oiws/” . The core of his research lies in creating, developing, and designing smart systems that optimize available resources, with a particular emphasis on advancing the capabilities of smart systems through innovative applications of artificial intelligence (AI) and edge computing. His lab also explored applications in healthcare and transportation systems to enhance efficiency and effectiveness by utilizing AI algorithms. You may check more details about his current projects.

Research Interests

Machine learning and artificial intelligence, Data science and big data, Light Detection and Ranging (LiDAR), Smart systems and smart cities, Reconfigurable intelligent surfaces. Edge computing. Wireless networks, Optical wireless. Spectrum sharing.

Education

- PhD in Electrical and Computer Engineering, Iowa State University (ISU), USA
- MS in Electrical Engineering, King Abdullah University of Science and Technology (KAUST), Saudi Arabia
- BS in Electrical Engineering (with Honors), Jordan University of Science and Technology (JUST), Jordan

Dr. Daryl Beetner

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Biography

Daryl G. Beetner (Fellow, IEEE) received the B.S. degree in electrical engineering from Southern Illinois University, Edwardsville, IL, USA, in 1990, and the M.S. and D.Sc. degrees in electrical engineering from Washington University, St. Louis MO, USA, in 1994 and 1997, respectively. He is employed with the Missouri University of Science and Technology, Rolla, MO, USA (Missouri S&T), where he is a Professor of electrical and computer engineering and is the former Department Chair. He is the Director of the Missouri S&T Electromagnetic Compatibility Laboratory and is the Director of the Center for Electromagnetic Compatibility, a National Science Foundation Industry/University Cooperative Research Center. He was the 2020 recipient of the IEEE EMC Society Technical Achievement Award and the 2003 IEEE-HKN C. Holmes MacDonald Outstanding Young Electrical Engineering Professor and has won a number of best paper awards including the 2018 Richard B. Schulz Best Transaction Paper award honorable mention. He currently serves the IEEE EMC Society as the EMC Education Grants Chair, the Chair of TC-4 Electromagnetic Interference Control, and as a member of the EMCS Board of Directors. He serves IEEE as the Chair of the IEEE Medal for Environmental and Safety Technologies selection committee, as a member of the IEEE Medals Council, and as a member of the IEEE-HKN Outstanding Young Professional committee. His research interests span a wide variety of topics including electromagnetic immunity and emissions from the integrated circuit to the system level.

Research Interests

electromagnetic immunity and emissions from the integrated circuit to the system level

Education

- D.Sc in Electrical Engineering, Washington University at St. Louis
- MS in Electrical Engineering, Washington University at St Louis
- BS in Electrical Engineering, Southern Illinois University at Edwardsville

Dr. Rui Bo

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Biography

Dr. Bo is an associate professor of the Department of Electrical and Computer Engineering at Missouri University of Science and Technology (Missouri S&T, formerly known as University of Missouri Rolla). He received the BSEE and MSEE degrees in electric power engineering from Southeast University (China) in 2000 and 2003, respectively, and received the Ph.D. degree from The University of Tennessee, Knoxville (UTK) in 2009. He worked at ZTE Corporation and Shenzhen Cermate Technologies Inc. as a software engineer and then architect from 2003 to 2005, respectively. From 2009 to 2017, he worked at Mid-continent Independent Transmission System Operator (MISO) at Eagan, Minnesota, USA as an engineer, senior engineer, and then principal engineer and project manager. He joined Missouri S&T in 2017 as an assistant professor and was promoted to associate professor with tenure in 2023.
He is a Fellow of IET, and a Senior Member of IEEE. He is a recipient of National Science Foundation CAREER Award in 2024, DARPA Young Faculty Award in 2018, and University of Missouri System President's Award for Career Excellence - Early Career in 2020.

Research Interests

computation, optimization and economics in power system operation and planning; high performance computing; electricity market simulation, evaluation and design

Education

- Doctor of Philosophy, University of Tennessee, Knoxville
- MS, Southeast University (China)
- BS, Southeast University (China)

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Biography

Minsu Choi received his Ph.D. degree from Oklahoma State University in 2002. Then, he joined the Department of Electrical and Computer Engineering at Missouri University of Science & Technology in 2003.
His research mainly focuses on High-performance computer Architecture & VLSI, Heterogeneous computing, Trustworthy computing, Embedded Systems, Fault Tolerance, Reliability Modeling and Analysis, Configurable Computing, Parallel & Distributed Systems, Dependable Instrumentation & Measurement. He is a senior member of IEEE and a member of ACM, KSEA, Sigma Xi and Golden Key.

Research Interests

Computer architecture & VLSI; Embedded systems; Fault tolerance; Testing; Quality assurance; Reliability modeling & analysis; Configurable computing; Distributed systems; Dependable instrumentation & measurement

Education

- PhD in Computer Science, Oklahoma State University (Dissertation Title: System-on-Chip Design for Reliability OSU Research Excellence Award Recipient)
- MS in Computer Science, Oklahoma State University
- BS in Computer Science, Oklahoma State University

Dr. Kristen Donnell

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Biography

Kristen M. Donnell received her B.S.E.E. degree in May 2001 from Colorado State University, her M.S.E.E degree in December 2003 from the University of Missouri-Rolla, and her Ph.D. degree in Electrical Engineering at Missouri University of Science and Technology (Missouri S&T) in December 2010. She is currently an Associate Professor in the Department of Electrical and Computer Engineering at Missouri S&T and the Director of the Microwave Sensing Laboratory. Her current research interests include thermography, frequency selective surfaces, materials characterization, and microwave and millimeter wave nondestructive testing. Prior to starting her Ph.D. work, Kristen was employed by Raytheon Company, Tewksbury, MA, from 2003 to 2006 as a Systems Engineer and Electrical Engineer. Dr. Donnell is a Senior Member of IEEE and has been involved with the IEEE Instrumentation and Measurement Society since 2007. She currently serves as the Vice President of the Finance Committee and the Chair of theDistinguished Lecturer Program.

Research Interests

Microwave and thermographic nondestructive testing, embedded sensing, high frequency sensing, frequency selective surfaces, materials characterization, antenna design, modulated scatterers/antennas

Education

- PhD in Electrical Engineering, Missouri University of Science and Technology (Missouri S&T) (Dissertation: Development of Embedded Modulated Scatterer Technique: Single- and Dual-Loaded Scatterers)
- MS in Electrical Engineering, University of Missouri – Rolla (UMR) (Thesis: Microwave Reflection Properties of Mortar Exposed to Chloride Solutions: Measurements and Modeling)

Dr. Rohit Dua

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Biography

Rohit Dua, PhD, is an Associate Teaching Professor at Missouri University of Science and Technology, teaching at the Cooperative Engineering program, developed between Missouri University and Science and Technology and Missouri State University, housed at Missouri State University since January 2010. Previously, he worked as Assistant Professor at New York Institute of Technology.

Research Interests

Smart Embedded Sensing Systems; Artificial Neural Networks; Optoelectronic Sensors; Biomedical and Energy Engineering Applications; Engineering Education

Education

- PhD in Electrical Engineering, Missouri University of Science and Technology (MST) (Emphasis Area: Fiber Optic Sensors and Artificial Neural Networks | Dissertation Title: "Neural Network Demodulator for Bragg Strain Sensors." | Advisors: Drs. Steve E. Watkins and Donald C. Wunsch II)
- MS in Electrical Engineering, Missouri University of Science and Technology (MST) (Emphasis Area: Fiber Optic Sensors and Artificial Neural Networks | Thesis Title: "Vibration Analysis Using Extrinsic Fabry-Perot Interferometric Sensors and Neural Networks." | Advisors: Drs. Steve E. Watkins and Donald C. Wunsch II)
- BE in Electronics & Telecommunications, University of Pune, India

Dr. Kelvin Erickson

Curators' Distinguished Teaching Professor of Electrical and Computer Engineering, EE Undergraduate Coordinator
Electrical Engineering

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Biography

Dr. Kelvin Erickson, is a Curators' Distinguished Teaching Professor of Electrical and Computer Engineering and a Fellow of ISA. He has been at Missouri S&T since 1986 and served as the Dept. Chairman from 2002 to 2014. He has over 40 years' experience with programmable logic controllers (PLCs) and distributed control systems (DCS). He was a software design engineer at Fisher Controls for 6 years prior to joining the faculty of S&T. At S&T, his area of expertise has been automation engineering and process control. For the past 30 years, he has taught regular college courses and short courses on programming for Rockwell Automation, Siemens, Modicon, and Emerson/GE PLCs. In 1997, he was on a sabbatical leave at Magnum Technologies (now Maverick Technologies) working on various PLC projects. He is an ABET Evaluator and Team Chair, currently serving as an ETAC Commissioner. In addition, he authored Programmable Logic Controllers: An Emphasis on Design and Application, 4th Ed. (Dogwood Valley Press, 2023) and Allen-Bradley PLCs: An Emphasis on Design and Application, 2nd Ed. (Dogwood Valley Press, 2023) and co-authored Plantwide Process Control (Wiley, 1999).

Research Interests

Control Systems, Factory Automation, Programmable Logic Controllers, Advanced Process Control

Education

- PhD in Electrical Engineering, Iowa State University
- MS in Electrical Engineering, University of Missouri-Rolla
- BS in Electrical Engineering, University of Missouri-Rolla (now known as Missouri University of Science and Technology)

Dr. Mina Esmaeelpour

Assistant Professor

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Biography

Mina Esmaeelpour has been a tenure-track assistant professor in the Electrical and Computer Engineering Department at Missouri University of Science and Technology (formerly known as the University of Missouri-Rolla or UMR) since September 2019. Her laboratory mainly focuses on fiber optic sensor design for various applications, including biomedical imaging and biosensing, gas and chemical sensing, time-stretch LIDAR, precision spectroscopy, and nonlinear fiber optics for quantum lasers and future telecommunication systems. Dr. Esmaeelpour received her Ph.D. in physics from Lehigh University.She performed most of her Ph.D. work at Bell Labs in Holmdel, NJ, where she interned from 2011-2015. She then became a postdoctoral research scholar at Stanford's Ginzton Laboratory in 2016 before joining the Molecular Imaging Instrumentation Laboratory (MIIL) at Stanford School of Medicine's molecular imaging program (MIPS) in 2018.

Research Interests

fiber optic sensors, microwave photonics, fiber optic lasers, ultrafast imaging and spectroscopy

Education

- PhD in Physics, Lehigh University
- MS in Solid State Physics, University of Tabriz
- BS in Physics, University of Tabriz

Dr. Mehdi Ferdowsi

Schlumberger Endowed Professor, Associate Dean for Research in CEC

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Biography

Mehdi Ferdowsi obtained his Ph.D. in Electrical Engineering from the Illinois Institute of Technology. Currently, he holds the Schlumberger Endowed Professorship in Electrical and Computer Engineering at Missouri University of Science and Technology (Missouri S&T). Moreover, Dr. Ferdowsi serves as Associate Dean for Research in the College of Engineering and Computing and was a Program Director at NSF within the Division of Engineering Education and Centers from 2020-2022. His research focuses on power electronics, energy storage technologies, smart grids, transportation electrification, and wide bandgap devices; additionally, he is an Associate Editor for the IEEE Transactions on Power Electronics.

Research Interests

power electronics, energy storage technologies, smart grids, transportation electrification, and wide bandgap devices

Education

- PhD in Electrical Engineering, Illinois Institute of Technology
- MS in Electrical Engineering, Sharif University of Technology
- BS in Electrical Engineering, University of Tehran

Dr. Rex Gerald

Research Professor

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236 Emerson Electric Co. Hall

Biography

Specialist in NMR/MRI probes and fiber-optic sensors. Broad interests in high-impact R&D. Writer and editor of scientific research manuscripts, proposals, and intellectual property documents.

Research Interests

Nuclear Magnetic Resonance Spectroscopy, Magnetic Resonance Imaging, RF EM Resonators, Nanostructured Materials, Optical Fiber Sensors, Pathogen Sensors, Blunt- and Blast-Force Sensors, Process of Innovation, Patent Process

Education

- PhD, University of Illinois/Chicago
- Conjoint thesis in Physical Chemistry, University of Illinois/Chicago and Molecular Crystal Physics, Max Planck Institute/Heidelberg
- BA in Chemistry, The University of Chicago

Dr. Jie Huang

Roy A. Wilkens Endowed Associate Professor

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Biography

Dr. Jie Huang, the Roy A. Wilkens Endowed Associate Professor of Electrical and Computer Engineering at Missouri University of Science and Technology, is a distinguished expert in sensor technologies, particularly for extreme environments. With a Ph.D. from Clemson University, he has significantly contributed to the field, leading the Lightwave Technology Laboratory (LTL) at Missouri S&T. The LTL lab mission is for advances in optical and microwave sensors with anomalously high sensitivity and resolution that open new frontiers in basic and applied research for the benefit of human health and knowledge. His research, funded by prestigious agencies like the DOE, DOD, NSF, NIH, DARPA, Army, Air Force, and national labs, focuses on optical and microwave sensors with applications in energy, infrastructure, and biomedical sensing. Dr. Huang's work, which includes developing advanced fiber optic sensors for industrial applications and pioneering electronic nose sensor elements, has resulted in over 150 refereed articles and more than 10 US patents. Dr. Huang has been named in the world's top 2% of Scientists List in "Optoelectronics & Photonics" for the past three consecutive years (2021 - 2023) conducted by Elsevier and published by Stanford University. Dr. Huang's work stands as a testament to his commitment to advancing technology to address real-world challenges, making substantial contributions to both academia and industry.

Research Interests

Fiber optic sensors; Sensors and instrumentation for applications in harsh environments; Optical sensors for biomedical applications.

Education

- PhD, Electrical Engineering, Clemson University

Dr. Ali Hurson

Professor

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Biography

Publication of over 360 articles in technical journals and conferences. Research funding by NSF, Department of Education, Department of Transportation, DARPA, Air Force, Office of Naval Research, Oak Ridge National Lab, NCR Corp., General Electric, IBM, Lockheed Martin, Penn State University, and Missouri S&T. Editor-in-Chief of Advances in Computers, Editor-in-Chief Journal of Sustainable Computing and Communication.

Research Interests

High performance computers, Pervasive computing, Mobile databases, Personalized education, Intelligent Transportation Systems, Cyber-Physical Systems, Big Data, Recommender Systems.

Education

- PhD, University of Central Florida
- MS, University of Iowa
- BS, University of Tehran, Iran

Dr. Chulsoon Hwang

Woodard Associate Professor for Excellence

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Biography

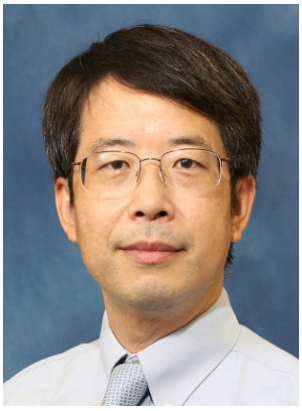
Chulsoon Hwang is with the EMC Laboratory at Missouri S&T. He received his Ph.D. degree from KAIST, Daejeon, South Korea in 2012. From 2012 to 2015, he was with Samsung Electronics as a Senior Engineer. In 2015, he joined the Missouri S&T where he is currently an associate professor. He has authored or co-authored 150+ IEEE journal/conference papers. His research area includes RF desense, signal/power integrity, electromagnetics, and machine learning applications in hardware design.

Research Interests

High-speed Digital System Design, RF/digital Integration (RF Desensitization), Machine Learning in Hardware Design, Electromagnetic Interference (EMI), Hardware Security/ Intentional EMI, and Electromagnetics.

Education

- Doctor of Philosophy, University of Tennessee, Knoxville



Dr. Lijun Jiang

Kummer Endowed Professor

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Biography

Dr. Lijun Jiang is a Kummer Endowed Professor at Department of Electrical and Computer Engineering, Missouri University of Science and Technology. He received Ph.D degree from University of Illinois at Urbana-Champaign in 2004 and had working experiences in academies and industries. He is an IEEE Fellow and ACES Fellow. He has received the IEEE Technical Achievement Award, IBM Research Technical Achievement Award, UIUC Y.T.Lo Outstanding Research Award, HP STAR Award, etc. His research interests include heterogeneous electromagnetic modeling methodologies, high speed electronic physical design and EDA solutions, machine learning for SI/PI and EMC/EMI, microwave material engineering, and optics, etc.

Research Interests

Electromagnetics, EMC, Signal Integrity and Power Integrity, Microwave Engineering

Education

- PhD in Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, USA
- MS in Electrical Engineering, Tsinghua University, China
- BS in Electrical Engineering, Beijing University of Aeronautics and Astronautics, China

Dr. Victor Khilkevich

Research Professor

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Biography

Victor Khilkevich received his Ph.D. degree in electrical engineering from Moscow Power Engineering Institute, Technical University, Moscow, Russia, in 2001. He is currently a Research Professor in the Department of Electrical and Computer Engineering at Missouri S&T. His current research interests include microwave imaging, automotive electromagnetic compatibility modeling, and high-frequency measurement techniques. He is the recipient of the Missouri University of Science and Technology 2020 Faculty Achievement Award, IEEE Transactions on Electromagnetic Compatibility 2019 Distinguished Reviewer Award, and the IEEE EMC Society 2020 Technical Achievement Award.

Research Interests

Electromagnetic compatibility

Education

- PhD, Moscow Power Engineering Institute (MPEI) (Thesis title: “Solving of Radio Frequency Inverse Problems with Neural Networks”)
- MS, Moscow Power Engineering Institute (MPEI) (Thesis title: “Reconstruction of Permittivity Profile of Dielectric Objects”)

Dr. Chang-Soo Kim

Professor, ECE Graduate Coordinator

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Biography

Change-Soo Kim received the B.S., M.S., and Ph.D. degrees in electronic and electrical engineering from Kyungpook National University, Daegu, South Korea in 1989, 1991, and 1997, respectively. As a Research Associate at the Sensor Technology Research Center, South Korea, he was involved in various research projects and commercial developments of microelectrochemical sensors and systems for monitoring gases, electrolytes, and biomolecules. At the Biomedical Microsensors Laboratory at North Carolina State University, Raleigh, and the Experimental Cardiology group, University of North Carolina at Chapel Hill, he conducted postdoctoral research on intelligent biochemical sensors, implantable device platforms, and cardiac biopotential recording with micromachined probes. He joined the Missouri University of Science and Technology (formerly University of Missouri-Rolla) in 2002 as an Assistant Professor of Electrical & Computer Engineering. Now he is a Professor with research interests including microsystem technologies and novel applications of microsystems to medical, biological and environmental engineering. Dr. Kim served as principal investigator of many federal grants funded by NASA, NSF, NIH and USDA including his NSF CAREER award. He is a senior member of IEEE and serving as an Associate Editor of IEEE Sensors Journal.

Research Interests

Bioinstrumentation, Sensors, Solid-state devices, Microsystems, MEMS, 3D-printed devices, Nanotechnology applications

Education

- PhD in Sensors Engineering, Kyungpook National University, South Korea
- MS in Semiconductor Engineering, Kyungpook National University, South Korea
- BS in Electronic & Electrical Engineering, Kyungpook National University, South Korea

Dr. DongHyun (Bill) Kim

Assistant Professor

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Biography

DongHyun (Bill) Kim received B.S., M.S. and Ph.D. degrees in electrical engineering from Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Republic of Korea, in 2012, 2014 and 2018, respectively. In 2018, he joined the Missouri University of Science and Technology (formerly University of Missouri-Rolla), Rolla, MO, USA, and is currently an Assistant Professor with the Missouri S&T EMC Laboratory, Rolla, MO, USA. His current research interests include nanometer-scale devices, through-silicon via (TSV) technology, dielectric material characterization and signal integrity (SI), power integrity (PI), temperature integrity (TI), electromagnetic compatibility (EMC) and electrostatic discharge (ESD) in 2.5D/3D IC systems. He is a recipient of IEEE-HKN Outstanding Young Professional Award, IEEE EMC Society Herbert K. Mertel Young Professional award, the IEEE Region 5 Outstanding Young Professional (formerly GOLD) Award, IEEE St. Louis Section Outstanding Young Engineer Award, IEEE APEMC Outstanding Young Scientist Award and DesignCon Best Paper Award. He is a co-recipient of DesignCon Early Career Best Paper Awards and IEEE EMC Symposium Best Paper Awards. He is currently serving as the vice-chair of IEEE EMC Society TC-10 (Signal Integrity and Power Integrity) and the Chair of IEEE St. Louis Section.

Research Interests

Signal Integrity (SI), Power Integrity (PI), and Temperature Integrity (TI); Electrostatic Discharge (ESD); High-speed SerDes Channel Modeling; High-speed Printed Circuit Board (PCB) Material Characterization; Particle Simulation on Semiconductor Devices

Education

- PhD in Electrical Engineering, KAIST, Daejeon, Korea
- MS in Electrical Engineering, KAIST, Daejeon, Korea
- BS in Electrical Engineering, KAIST, Daejeon, Korea

Dr. Jonathan Kimball

Department Chair and Fred W. Finley Distinguished Professor

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Biography

Jonathan Kimball began his career in industry at Motorola, designing IGBT modules, and Baldor Electric, designing industrial motor drives. He co-founded Smart Spark Energy Systems to commercialize technology from the University of Illinois. He joined the faculty at Missouri S&T in 2008. From 2019 to 2022, he was the director of the Center for Research in Energy and the Environment. Since 2022, he has been the chair of the ECE department.

Research Interests

Microgrids, renewable energy, energy storage, electric vehicle charging infrastructure, power electronics

Education

- PhD in Electrical & Computer Engineering, University of Illinois at Urbana-Champaign
- MS, Electrical Engineering, University of Illinois at Urbana-Champaign
- BS in Electrical & Computer Engineering, Carnegie Mellon University

Dr. Jian Liu

Assistant Research Professor

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Biography

Jian Liu is currently an Assistant Research Professor at the Kummer Institute Center for Artificial Intelligence and Autonomous Systems and the Department of Electrical and Computer Engineering at Missouri S&T. He was a distinguished full professor at Nanjing University of Information Science and Technology. He has been a Ph.D. student, visiting scholar, and postdoctoral fellow at Penn State University, the University of Washington, Tsinghua University, Missouri S&T, and the University of Houston. His research has been published in leading journals such as Applied Energy, European Journal of Operational Research, IEEE Transactions on Power Systems, Service Science, and Production and Operations Management.

Research Interests

Artificial Intelligence and Machine Learning (Explainable AI, Reinforcement Learning and Deep Learning, Classification and Clustering, Real-time Object Detection);
Energy Economics and Sustainable Operations (Electricity Market Optimization, EV Smart Charging, Energy Storage Optimization, Distributed Energy Resources Management);
Operations Research and Operations Management (Uncertain Decision Making, Behavioral Queueing, Supply Chain Optimization, Complex Product Manufacturing Operation)

Education

- Ph.D in Electrical Engineering, Missouri University of Science and Technology.
- PhD in Management Science and Engineering, Nanjing University of Aeronautics and Astronautics

Dr. Farhan Mumtaz

Assistant Research Professor

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Biography

Farhan Mumtaz (Senior Member, IEEE) received the bachelor's degree in science from Punjab University Lahore, Lahore, Pakistan, in 2006, the master's degree in electronics from Quaid-i-Azam University Islamabad, Islamabad, Pakistan, in 2018, and the Ph.D. degree in information and communication engineering from the Wuhan University of Technology, Wuhan, China, in 2021.

In February 2022, he starts working with the Faculty of Electrical and Computer Engineering, Missouri University of Science and Technology, Rolla, MO, USA, where he is currently as an Assistant Research Professor. From 2007 to 2015, he worked for Huawei Technologies (Pvt.) Ltd., Islamabad, Pakistan, holding a number of important positions, including a Plan Control Manager, a Project Manager, and a Service Solution Manager. He has authored and coauthored more than 40 peer-reviewed high-ranking journal articles and has filed 01 US-patent application. His current research interests include sapphire crystalline fibers, fiber Bragg gratings, femtosecond micromachining of optoelectronic materials, Rayleigh and Brillion sensors, surface plasmons, biosensors, photonic crystal fiber design, and instrumentation of fiber optic sensors for energy and harsh environments in U.S. steelmaking industry.

Research Interests

Fiber optic sensors; Novel micro/nano materials, structures, devices and sensors; Micro-machining, processing, and characterization of Optical Design; Harsh environment Sensing and instrumentation; Fiber optic SPR, Chemical and Bio-Sensors

Education

- Ph.D. in Information and Communication Engineering, Wuhan University of Technology, China
- M. Phil in Electronics, Quaid-i-Azam University Islamabad, Pakistan
- M.Sc. Electronics, Preston University Kohat, (Islamabad Campus), Pakistan

Dr.Mohamed Nafea

Assistant Professor

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131 Emerson Electric Co. Hall

Biography

Mohamed Nafea is an Assistant Professor in the Electrical & Computer Engineering (ECE) department at Missouri University of Science & Technology. Before joining Missouri S&T, he was an Assistant Professor in the ECE department at University of Detroit. Prior to that, he spent a year as a postdoctoral researcher at Georgia Tech, ECE. He received his Ph.D. degree in electrical engineering from Penn State University Park in December 2018, under supervision of Prof. Aylin Yener. He also received a masters degree in mathematics from Penn State in 2017. His research lies at the intersection of statistical learning, information and data sciences, and causal reasoning, and aims to solve problems in responsible artificial intelligence including issues of fairness, privacy, security, and explainability of learning systems. He is a recipient of the 2023 NSF CISE Research Initiation Initiative (CRII) award in support of his research in fair machine learning.

Research Interests

Fair & interpretable machine learning; causal learning and reasoning; federated learning and distributed optimization; information security and privacy

Education

- PhD in Electrical Engineering, Penn State University, University Park, 2018
- Master's in Mathematics, Penn State University, University Park, 2017 - Master's in Wireless & Information Technology, Nile University, Egypt, 2012
- Bachelor's in electrical engineering (Electronics & Communications Section), Alexandria University, Egypt 2010.

Dr. Tayo Obafemi-Ajayi

Associate Professor, Mace/ Turblex Professor of Engineering
Missouri State University Cooperative Engineering Program

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Biography

Dr. Tayo Obafemi-Ajayi is the Mace/Turblex associate Professor of Electrical Engineering at Missouri State University in the Cooperative Engineering program (joint agreement with Missouri University of Science and Technology). She is also the faculty director of the Computational Learning Systems lab and the site coordinator for the Missouri Louis Stokes Alliance for Minority Participation (MoLSAMP) at the university. She serves as the chair of IEEE CIS Bioinformatics and Bioengineering Technical Committee (BBTC). She also serves as a Technical Representative on the IEEE Engineering in Medicine and Biology Society (EMBS) Administrative Committee. Her research centers on development and applications of explainable machine learning algorithms. Motivated by practical needs in biomedical applications, her overall goal is to design intelligent systems that analyze large data sets to yield novel discoveries and make meaningful predictions.

Research Interests

Explainable Artificial Intelligence, Control Systems, Bioinformatics, Data Mining

Education

- PhD in Computer Science, Illinois Institute of Technology (IIT), Chicago IL
- MS in Electrical Engineering
- BS in Electrical Engineering (High Honors)

Dr. Theresa Odun-Ayo

Director, Cooperative Engineering Program
Missouri State University Cooperative Engineering Program

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Missouri State University PCTR 2001B, 901 S National Springfield

Biography

Dr. Theresa Odun-Ayo is the director of the Missouri State University/Missouri S&T Cooperative Engineering Program. She joined the program as a full-time faculty in 2011. She worked as a faculty at the Nigerian Defense University for two years and was a Principal Electrical Engineer with the Nigerian Airspace Management Agency for five years before coming to the United States for further studies. She holds both a bachelor's and master's degree in Electrical Engineering from ATBU Bauchi and The University of Benin respectively. She has two doctoral degrees, a Ph. D in Electrical Engineering degree from Missouri S&T and a Dmin in leadership from Evangel University. She is passionate about making sustained impact in her career and community.

Research Interests

STEM Education Pedagogy, K-12 STEM pipelines, social and gender issues in STEM, Institutional Research, Power systems stability, Smart grid.

Education

- PhD in Electrical Engineering, Missouri University of Science and Technology (Missouri S&T), Rolla
- MEng in Electronics and Telecommunication, University of Benin, Benin-City, Nigeria
- BEng in Electrical/Electronics Engineering, Abubakar Tafawa Balewa University, Bauchi, Nigeria

Dr. Jag Sarangapani

William A. Rutledge - Emerson Electric Company Distinguished Professor

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222 Emerson Electric Co. Hall

Biography

Jag Sarangapani is a Curators' Distinguished Professor and Rutledge-Emerson Chair at the Missouri University of Science and Technology, Rolla, MO, USA. He was the Site Director for the graduated NSF Industry/University Cooperative Research Center on Intelligent Maintenance Systems for 13 years and an Interim Director for Intelligent Systems Center. He also has a courtesy appointment with the Department of Computer Science. He has co-authored 195 peer-reviewed journal articles, around 300 refereed IEEE conference articles, several book chapters, and co-authored five books and two edited books. He holds 21 patents, one defense publication, with several pending. He has supervised the completion of over 33 doctoral students and 31 M.S. thesis students. His research funding is in excess of $20 million dollars (his shared credit over $11 million) from NSF, NASA, AFOSR, ARO, ONR, AFRL, Boeing, Honeywell, Sandia and from other companies. His current research interests include learning, adaptation, decision making and control, networked control systems/ cyber physical systems, prognostics/bigdata, and autonomous systems/robotics with healthcare applications. He served/ serving on various editorial boards and as a co-editor for the IET Book series on Control.

Research Interests

Learning, adaptation and control, neural networks, secure cyber-physical-human systems, big data prognostics, robotics/ autonomous systems.

Education

- Ph.D. University of Texas, Arlington, Texas
- MS. University of Saskatchewan, Saskatoon, Canada
- BE. Anna University, Chennai, India

Dr. Sahra Sedigh Sarvestani

Associate Professor and Distance Coordinator for ECE, S&T Faculty Ombuds

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135 Emerson Electric Co. Hall

Biography

Dr. Sahra Sedigh Sarvestani is an Associate Professor of Electrical and Computer Engineering and Computer Science (by courtesy), a Research Investigator with the Intelligent Systems Center, and Faculty Ombuds at the Missouri University of Science and Technology. She holds a BS in electrical engineering from the Sharif University of Technology, and an MS in electrical engineering and PhD in electrical and computer engineering from Purdue University. Her research centers on analysis and modeling of dependability for complex systems, with focus on critical infrastructure and cyber-physical systems. Her past and present research sponsors include the National Science Foundation, the US and Missouri Departments of Transportation, the Department of Education, the National Security Agency, the European Commission, and private industry. She is a Fellow of the National Academy of Engineering's Frontiers of Engineering Education, a Senior Member of the IEEE, and a member of the IEEE Computer Society's Golden Core and IEEE-HKN.

Research Interests

Stochastic modeling of complex systems, dependability and security, failure propagation, cyber-physical systems, critical infrastructure, educational technology.

Education

- PhD in Electrical and Computer Engineering, Purdue University
- MS in Electrical Engineering, Purdue University
- BS in Electrical Engineering, Sharif University of Technology

Dr. Pourya Shamsi

Associate Professor

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Biography

Pourya Shamsi received the B.Sc. degree in electrical engineering from the University of Tehran, Tehran, Iran, in 2007, and the Ph.D. degree in electrical engineering from The University of Texas at Dallas, Richardson, TX, USA, in 2012. Shamsi is currently an Associate Professor of Electrical Engineering with the Missouri University of Science and Technology. His research interests include power electronics, micro grids, motor drives, medium voltage converters, battery chargers, and control.

Research Interests

Power electronics, motor drives, control, micro grid, renewable energy, energy management, battery chargers, grid interfaces, medium voltage

Education

- Post Doctorate Research Associate, Electrical Engineering The University of Texas at Dallas, Richardson, TX USA (Research Topic: Automotive Drive Systems for Double Stator Switched Reluctance Motors)
- PhD in Electrical Engineering, University of Texas at Dallas
- BS in Electrical Engineering, University of Tehran, Tehran, Iran

Dr. Bijaya Shrestha

Associate Teaching Professor

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215 Emerson Electric Co. Hall

Biography

Dr. Shrestha was born to Prof. Kalidas Shrestha and Mrs. Kamala Maiya Joshi in Kathmandu, Nepal. He earned a Ph.D. degree in 1995 from the University of Missouri-Rolla (UMR) for developing a Monte Carlo algorithm to model Photon Transport in a semiconductor. His research interests include particle transport, pattern recognition, feature extraction and identification, and medical applications. He has been teaching various courses in the Department of Electrical and Computer Engineering at the Missouri University of Science and Technology for twenty eight years continuously (as of 2023), where he has been working on developing algorithms to help detect skin cancer in its early stages by performing image analysis of skin legions for which he and his research colleagues have been rewarded a US patent. He is in the process of developing an inference engine which inputs a lesion image and outputs a recommendation for its remedy.

Research Interests

Algorithm development for feature extraction towards helping diagnose cancerous lesions, signal and image processing, statistical physics, particle transport, radiation shielding, Monte Carlo techniques, stochastic events, Markov chain models, simulation of physical processes, optimization techniques.

Education

- PhD, University of Missouri-Rolla, Rolla, MO
- MS, Tribhuvan University, Kathmandu Nepal
- BS, Tribhuvan University, Kathmandu Nepal

Dr. Joe Stanley

Professor, Associate Chair, Academic Affairs and Computer Engineering Coordinator

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127 Emerson Electric Co. Hall

Biography

In my experience as a graduate student, an Engineering Specialist at Systems & Electronics, Inc. and as a faculty member at Missouri S&T, I have pursued multidisciplinary research collaborations in areas including U.S. postal applications, dermatology skin lesion analysis, pre-cervical cancer assessment from digitized histology images, content-based image retrieval, atomic force microscopy, nondestructive evaluation of aging aircraft lap joints, humanitarian demining, traffic monitoring, osteoarthritis assessment from cervical and lumbar spine x-ray images, intrusion detection and system survivability, and bioinformatics. In these research collaborations, in my research experience, I have worked with dermatologists, pathologists, cytologists, radiologists in the development of computer-assisted tools for biomedical image analysis. My research focus has been the investigation of image and signal processing, computational intelligence, and data fusion algorithms and techniques for computer-assisted tools to aid domain experts in the decision-making process. In addition, I have a heart-felt passion for teaching. In STEM education, I trained high school teachers in Digital Electronics for 13 years as part of the Missouri S&T hosted Project Lead the Way summer training programs. I have mentored/advised 11 undergraduate research projects and co-mentored numerous other undergraduate students in the Image Processing Laboratory at Missouri S&T. I served as the Senior Design project advisor for 18 projects. I have been the thesis advisor for 30 MS graduates and eight PhD graduates. In conjunction with these efforts and as an instructor working with the tremendous students at Missouri S&T, I earned an IEEE USA Professional Service Award in 2015 and the IEEE-HKN international C. Holmes MacDonald Outstanding Teaching Award in 2016.

Research Interests

Computational Intelligence, Biomedical Image and Signal Processing, Data Fusion, Machine and Deep Learning, Medical Informatics, Precollege STEM Education Outcomes

Education

- PhD in Computer Engineering and Computer Science, University of Missouri-Columbia
- MS in Electrical Engineering, University of Missouri-Columbia
- BS in Electrical Engineering, University of Missouri-Columbia

Dr. Theresa Swift

Teaching Professor, Laboratory Coordinator

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Biography

Theresa Swift is Teaching Professor of Electrical Engineering at Missouri University of Science and Technology, formerly the University of Missouri-Rolla. She received her Ph.D. in Electrical Engineering at Missouri University of Science and Technology, Rolla, MO in 2009. Her technical interests include smart structure sensors and engineering education. She is a member of IEEE and ASEE and active in IEEE-HKN.

Research Interests

Engineering education

Education

- PhD in Electrical Engineering, Missouri University of Science and Technology
- MS in Electrical Engineering, Missouri University of Science and Technology
- MS in Applied Mathematics, Missouri University of Science and Technology
- BS in Mathematics, Southeast Missouri State

Dr. Steve E.Watkins

Professor of Electrical and Computer Engineering HKN & TBP Faculty Advisor

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Biography

Dr. Steve E. Watkins is Professor of Electrical and Computer Engineering and Director of the Applied Optics Laboratory at the Missouri University of Science and Technology (formerly the University of Missouri--Rolla). Dr. Watkins is active in IEEE (senior member), IEEE-Eta Kappa Nu, SPIE (Fellow Member), ASEE, and Tau Beta Pi. He served as the 2018 President of IEEE-HKN and 2019-2022 Vice-President of Educational Activities of the IEEE Education Society. His research and teaching interests include smart sensor systems, UAV instrumentation, fiber optics, imaging, engineering education, and pre-college education. He was an IEEE-USA Congressional Fellow, a Distinguished Visiting Professor at the USAF Academy, Visiting Research Physicist at the USAF Phillips Laboratory, and a Visiting Scholar for NTT Japan. He was coordinator of the campus Smart Composite Bridge project and is advisor to the following student groups: IEEE-Eta Kappa Nu and Tau Beta Pi. Dr. Watkins earned Bachelor of Science and Master of Science degrees in electrical engineering from Missouri S&T in 1983 and 1985, respectively. He also holds a Ph.D. in electrical engineering from the University of Texas at Austin. Watkins joined the Missouri S&T faculty in 1989 as an assistant professor of electrical engineering. He was named associate professor in 1996 and professor in 2004. He served as Interim Department Chair from June 2020 to July 2022 and is a member of the Academy of ECE at Missouri S&T.

Research Interests

Smart Sensor Systems, fiber optics, UAV instrumentation, engineering education, and pre-college education

Education

- PhD in Electrical Engineering, The University of Texas at Austin
- MS in Electrical Engineering, University of Missouri-Rolla
- BS in Electrical Engineering, University of Missouri-Rolla

Dr. Robert Woodley

Associate Teaching Professor, Advising and Recruiting Specialist, CEC Dean's Educator

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115 Emerson Electric Co. Hall

Biography

Dr. Woodley joined the faculty of the department of electrical & computer engineering at Missouri University of Science and Technology in January 2018 and is currently an Associate Teaching Professor. Previously, he worked in industry for 14 years including the co-founder of a small company. His position at Missouri S&T is structured to include significant service activities in the area of advising and recruiting. Dr. Woodley has shown particular leadership in the senior design sequence. Dr. Woodley introduced entrepreneurial components in this course, such as customer interviews, to encourage customer-centric and economics-driven design decisions, as would occur in industry. Dr. Woodley has restructured the sophomore level CpE 2210, Introduction to Digital Logic course, in response to the needs revealed by the COVID-19 pandemic, into an online asynchronous format. He has also co-authored the textbook for CpE 2210 and developed an online lab for the course. Dr. Woodley has been a member of IEEE since 2004. He serves as a resource for the local IEEE student branch. He is currently the treasurer of the IEEE Rolla Subsection. Dr. Woodley has been awarded the 2022 IEEE Outstanding Educator for the St. Louis Section, Missouri S&T 2022 Faculty Achievement Award, and the College of Engineering and Computing Dean's Educator award for 2023.

Research Interests

Computational Intelligence, Embedded Systems, Digital Logic, Control Systems

Education

- PhD in Electrical Engineering, University of Missouri – Rolla
- MS in Electrical Engineering, University of Missouri – Rolla
- BS in Electrical Engineering, University of Missouri – Rolla

Dr. Cheng-Hsiao Wu

Professor

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Biography

Dr. Cheng-Hsiao Wu is one of the very few scientists daring to show the fundamental flaws of using “qubits” (the Bible) for quantum computing. Dr. Cheng-Hsiao Wu is the first person to show the phase-computing nature of quantum computing at the fundamental level, and this brings our understanding of the nature of “time” (and time crystals) to a totally different level. Nonlocal theory also brings out the non-Euclidean “rule-based” science, as Sir Isaac Newton/Gottfried Leibniz developed the Calculus and Differential equations of the “local” approach for our science and engineering in the past 360 years. Now, this is changing as quantum parallel computing is being investigated. A new era is coming with the non-local theory of science, and Dr. Cheng-Hsiao Wu is a pioneer in that field by showing what kind of quantum computing one gets from an entangled chain of atoms. (Please see Selected Publication #1)

Research Interests

Nonlocal Quantum Parallel Computing Theory; Time crystals, Quantum teleportation; Discrete time and perpetual motion; New kind of science and origin of life.

Education

- PhD in Physics, University of Rochester
- MS in Mechanical and Aerospace Engineering, University of Rochester
- BS in Mechanical Engineering, National Taiwan University

Dr. Donald Wunsch II

Mary K. Finley Missouri Distinguished Professor. Director, Kummer Institute Center for Artificial Intelligence and Autonomous Systems. Director, Applied Computational Intelligence Laboratory

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Biography

Donald C. Wunsch II is the Mary K. Finley Missouri Distinguished Professor and Director of the Kummer Institute Center for Artificial Intelligence and Autonomous Systems at Missouri S&T. With extensive experience in AI research, he specializes in real-time and explainable unsupervised and reinforcement learning.

He holds a Ph.D. in Electrical Engineering and an M.S. in Applied Mathematics from the University of Washington, along with an Executive MBA from Washington University in St. Louis. He has held roles in academia, industry, and government, including serving as a Program Director at NSF (2021–2022), and has contributed significantly to clustering, adaptive resonance architectures, neurofuzzy regression, and smart grids.

An IEEE Fellow and recipient of multiple awards, he has published over 500 papers and 12 books and supervised 23 Ph.D. graduates. His leadership drives advancements in ethical and applied AI technologies.

Research Interests

Neural Networks, Fuzzy Systems, Evolutionary Computing, Explainable Artificial Intelligence, Unsupervised Learning, Reinforcement Learning,, Applications, Entrepreneurship, and Policy

Education

- EMBA in Business Administration, Washington University in St. Louis
- PhD in Electrical Engineering, University of Washington (Seattle)
- MS in Applied Mathematics, University of Washington (Seattle)
- BS in Applied Mathematics, University of New Mexico

Dr. Maciej Zawodniok

Associate Professor

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Biography

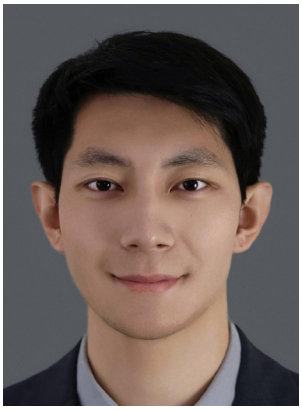
Maciej J. Zawodniok received the M.Sc. degree in computer science from the Silesian University of Technology, Gliwice, Poland, in 1999, and the Ph.D. degree in computer engineering from the Missouri University of Science and Technology, Rolla, MO, USA, in 2006.

Research Interests

Wireless sensor networks; Wireless ad-hoc networks; Passive FRID systems; Energy-efficient protocols; RF based localization; Embedded systems; Application of control theory and computational intelligence; Prognostics; Diagnostics

Education

- PhD in Computer Engineering, University of Missouri-Rolla (Dissertation topic “Distributed Power Control (DPC)-based Energy Efficient Protocols for Wireless Networks”)
- MS in Computer Science, Politechnika Śląska w Gliwicach (Poland) (Specialization: “Databases, Computer Networks and Systems” Advisor: Prof. Adam Mrozek)



Dr. Bohong Zhang

Assistant Research Professor

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Biography

Dr. Bohong Zhang is an Assistant Research Professor in the Department of Electrical and Computer Engineering at Missouri University of Science and Technology. He received his Ph.D. degree in Electrical Engineering from the Missouri University of Science and Technology. His current research interests center around advancing optical and microwave sensors and instrumentation, focusing on their applications in intelligent infrastructures, biomedical sensing, and challenging environments.

Research Interests

Fiber Optic Sensors; Optical Sensing, Imaging, and Spectroscopy; Characterization of Micro/Nano Material Structures; Sensors and Instrumentation for Applications in Harsh Environments; Ultrafast Laser Machining and Processing

Education

- PhD, Electrical Engineering, Missouri University of Science and Technology

Dr. Chen Zhu

Associate Research Professor

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Biography

Chen Zhu received the B.E. degree in optoelectronics information engineering from the Huazhong University of Science and Technology, Wuhan, China, in 2015, and the Ph.D. degree in electrical engineering from the Missouri University of Science and Technology, MO, USA, in 2021. His research interest is focused on the development of fiber optic and microwave devices for sensing applications in harsh environments. Dr. Zhu was a recipient of the IEEE Instrumentation and Measurement Society Graduate Fellowship Award from 2018 to 2019 and the 2020 IEEE St. Louis Section Outstanding Graduate Student Award.

Research Interests

Fiber optic sensors; microwave photonics; microwave sensors

Education

- PhD, Missouri University of Science and Technology, 2021

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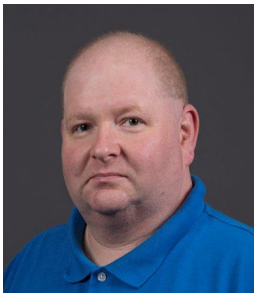

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