Electrical, Computer & Energy Engineering

Prospective Master's Student Webinar

University of Colorado Boulder

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Deadlines to submit grad school application

Now. Today. Better than two hours or even two days prior to the deadline itself. Please submit even prior to 15 Feb in case you need assistance with any part of it.

- **15 Feb 2025, 21:59pm / 9:59pm Colorado "Mountain" Time Zone:**
  Master's deadline (EEEN-MSEE, EEEN-MS, EEEN-ME)

https://www.colorado.edu/ecee/admissions/graduate-admissions/application-process

- Decisions will be posted in your applicant portal by 30 April Mountain Time Zone

- 01 Sept 2025: Deadline for all graduate degrees for spring 2026. Begin applying in July 2025. Decisions posted by mid-November

Professional (PMP) vs. Traditional Master's

- Employers in the U.S. do not care which of these you graduate with. They only care you have the skills and a master's in EE.

- Therefore, ***you*** need to consider:

  - 1. which area / subplan you wish to study in (some are solely PMP or Traditional, and you don't have a choice)
  - 2. tuition costs (these vary based on if you are State of Colorado resident or non-resident; visa students are always non-residents)
  - 3. availability of courses (Embedded Systems students have enrollment priority. Remaining seats might not be available until the second week of the semester for Computer Engineering or other non-ESE students, for example)
  - 4. whether you wish to do a thesis (almost none of our master's students do a thesis; only traditional master's have the option to do one)

Professional vs. Traditional Master's

Professional (Depth):
MSEE (<="Professional MS"), ME

*Leads to industry work after graduation; courses taught more by instructors recently from or still in industry
*Prohibited from doing a thesis;
*No tuition remission nor health insurance
* Can work as hourly-paid GLA (Graduate Learning Assistant), ~$33/hour, 5-10 hrs/week
*Tuition less expensive for out-of-state and visa students (about $15,360 less for the degree)
*Tuition more expensive for Colorado residents ($8,610)

Traditional (Breadth):
MS

*More PhD-track; courses taught more by tenure-track faculty
*Optional thesis
*Potential tuition remission and health insurance (but most likely working in another College dept)
* In ECEE Dept, the top Master's students work as hourly-paid GLA (Graduate Learning Assistant) ~$33/hour, 5-10 hrs/week
*Tuition more expensive for visa and out-of-state students $15,360)
*Tuition more affordable for Colorado residents ($8,610 less for the degree).

Differences between Master's Degrees in ECEE:
ME vs. MS vs. MSEE:

- **Professional Degrees:** Geared toward work in industry

  ME (Master of Engineering)

  MSEE (Professional Master of Science)

- **Traditional Degrees:** Geared toward research and PhD studies

  MS (Master of Science).

  PhD

The GRE is ***NOT*** required for any degree

ME degree lets you take additional, less-technical courses

- Under **MSEE** or **MS**, you can **maximally** take just **one** EMEN (Engineering Management) or other **'less technical' course** in an Engineering department (one with policy as its core, rather than mathematical or scientific problem solving).
- In contrast, the **ME degree permits up to five such courses** (15 course credit hours). (Just **three such courses** / 9 credit hours if you are an Embedded Systems (**ESE) ME student**).
- Two final, key points: 1) All ME degrees are PMP tuition (so, more expensive for CO residents; more affordable for non-residents and visa students); 2) theses prohibited for ME students.

Differences between Master's Degrees for general credit hours: 18/12 vs. 15/15 (or 21/9 for ESE)

- MSEE, MS and PhD all require a minimum of 18 of your 30 course credit hours (usually equivalent to 6 out of 10 courses) to be in ECEN 5000+ level course work...
- ...with the remaining 12 hours **optionally** in additional ECEN, or other STEM (Science, Technology, Engineering, Math)

- the ME requires 15 such hours in ECEE 5000+ with 15 **optionally** in other STEM courses.
- For ESE (Embedded Systems Engineering) ME students: The maximum is 9 such credit hours.

Summary of ECEE Master's Differences

PMP	Trad MS	ME
More depth (not a factor for Power choices). Must take 6-7 out of 10 courses in very specific area in the ECEE Dept.	More breadth (not a factor for Power choices); must take 6 ECEN 5xxx courses—but they can be from a large number of areas, optionally. Or, optionally, can come from jut one or two areas.	ME can opt to take more courses that are less technically challenging; MS degrees are limited to only one such course
More instructors from industry (not a factor for Power choices)	More tenure-track instructors (not a factor for Power choices)	Depends on subplan as in the examples to the left
More affordable for visa students and non-Colorado residents	More affordable for residents of Colorado	More affordable for visa students and non-Colorado residents
No thesis	Optional thesis	No thesis
Can work hourly paid	In ECEE, hourly paid, could potentially y be monthly paid as TA or RA for other STEM dept in rare instances	Can work hourly paid

Areas of Study in the ECEE Dept, Traditional Master's

- **Photonics and Quantum Engineering** (PQE)
- **Learning, Information, Network Communication & Data Sciences** (LINCD Sciences).
- **Computer Engineering** (CE) slightly more hardware, but still a lot of software (does not include faculty currently active in VLSI) Can give in-depth knowledge of which hardware is needed to support which software
- **Systems and Controls**
- **Electromagnetics, RF and Microwaves** (Emags)
- **Power Electronics & Renewable Energy** (mostly solar and wind and the controls systems for those, and battery life and electric vehicles)

Areas of Study in the ECEE Dept, Professional Master's

- Embedded Systems Engineering (ESE)
- Power Electronics (PPE)
- Next-Generation Power & Energy Systems (PPS)
- High-Speed Digital Engineering (HSDE)

• High-Speed Digital Engineering (HSDE) PMP

- Clock frequencies and data rates are increasing, driven by the high growth rate of internet traffic and computer processing power. For most electronic products, signal-integrity effects begin to be important at clock frequencies above about 100 MHz or rise times shorter than about 1 nsec. Interconnects — like circuit boards, cables and connectors — are not transparent. If you don't design them correctly, signal integrity (SI), power integrity (PI) and electromagnetic compatibility (EMC) problems can ruin any product.
- Professors from CU Boulder's faculty, local national labs and local industry will offer five core courses and numerous electives for a 10-course, 30-credit hour program to prepare students with the specialized knowledge required to be a successful high-speed design team member and be able to quickly and efficiently solve signal integrity, power integrity and EMC problems. This means having a firm grasp of the fundamental principles, hands on familiarity with the design tools, simulation tools, and measurement tools. The core curriculum will emphasize mastery of the industry established best design practices, best measurement practices and best analysis practices.
- https://www.colorado.edu/ecee/academics/graduate-programs/professional-masters/high-speed-digital-engineering

High-Speed Digital Engineering (HSDE) PMP

Core Courses

- Courses are 3 credit hours each. Students must take all 5, for a total of 15 credit hours.
- ECEN 5224 High Speed Digital Design
- ECEN 5514 Principles of EM for HSDE
- ECEN 5524 Principles of Comp EM for HSDE
- ECEN 5534 Practical Signal Integrity Measurements (fall)
- ECEN 5730 Practical PCB Design for Manufacture

Elective Courses

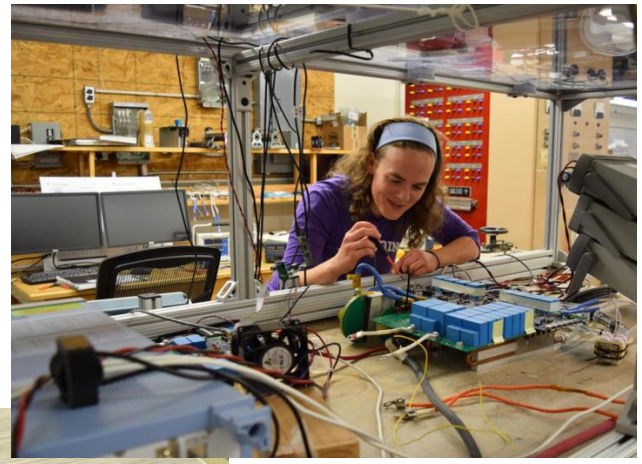
- Courses are 3 credit hours each. Students must take 2, for a total of 6 credit hours.
- ECEN 5013 Special Topic: Advanced PCB design for high-speed serial links
- ECEN 5414 Essential Principles of Signal Integrity
- ECEN 5424 High Speed Channel Design for Signal Integrity (spring 2024)
- ECEN 5434 S-Parameters for Signal Integrity in HSDE (fall)
- ECEN 5444 Electromagnetic Compatibility (EMC) for High-Speed Digital Engineering (fall)
- ECEN 5544 EM Signal Modeling for HSDE using Ansys HFSS and Q3D
- ECEN 5554 Designing PCB Memory Systems using Keysight ADS (fall)

Power Electronics and Renewable Energy Systems at ECEE

Vision: 100% Renewable Electric Power Grid and 100% Electrified Transportation

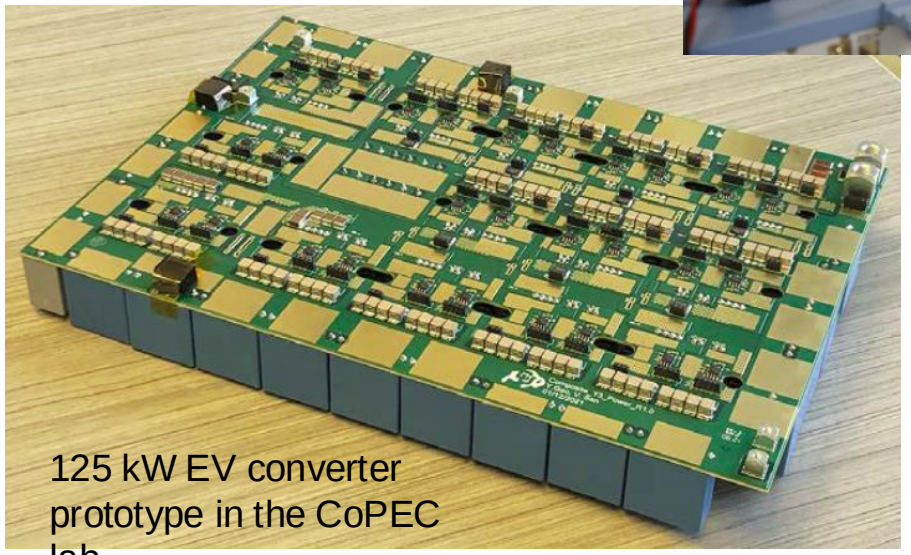
Prof. Luca Corradini, Prof. Bob Erickson, Prof. Bri-Mathias Hodge, Prof. Dragan Maksimovic

Colorado Power Electronics Center (CoPEC) students work on ultra-high efficiency power converters for energy efficiency, electric vehicles and renewable energy



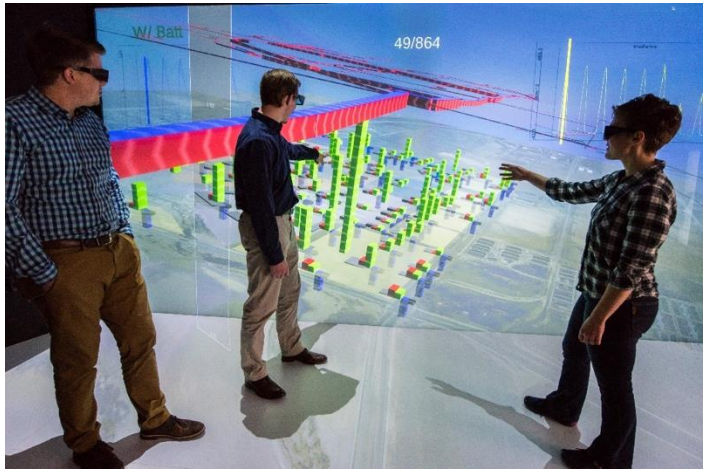
Power electronics and solar photovoltaic system lab exposition

Collaborations with National Renewable Energy Lab on advances in wind and solar based electric power systems



125 kW EV converter prototype in the CoPEC lab

CoPEC converter for electric vehicles is 4 times smaller and has 4 times lower losses compared to state-of-the-art industry solutions



Research at CU and internship opportunities for our students with industry, national labs, and ASPIRE NSF center for electrified transportation

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https://aspire.usu.edu/

ASPIRE

NSF Engineering Research Center

Advancing Sustainability through Powered Infrastructure for Roadway Electrification

Electric Vehicle and Roadway testbed at USU

Convergent research thrusts

Power

Transportation

Adoption

Data

https://aspire.usu.edu/

Utah State University

University of Colorado Boulder

UTEP

PURDUE UNIVERSITY

with more than 50 affiliated institutions and innovation partners

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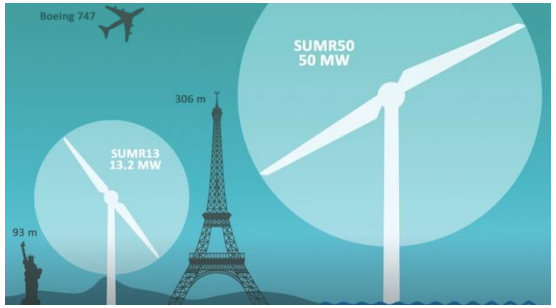
Lucy Pao
(2022-2023)

- **Currently active research projects are all related to control of wind energy systems**
  - **Extreme-scale wind turbines**
    - Blades longer than 100m
    - Very lightweight rotors
    - Upwind vs. downwind configurations
    - Two vs. three-bladed configurations
  - **Floating offshore wind turbines**
    - Novel lightweight floating platforms
    - Robust multi-input multi-output control methods
  - **Control co-design**
    - Automated controller tuning
  - **Coordinated control of wind farms**



[Image credit: Chao (Chris) Qin)]


[Illustration by J. Bauer, NREL]


Horns Rev 1 Shallow-Water Wind Farm, Denmark
[Photo credit: Christian Steiness]

Lucy Pao's research group is currently very heavily involved in investigating the control of wind energy systems.

To decrease the cost of wind energy, wind turbines are being designed at ever larger scales,
which is challenging due to greater structural loads and deflections.
Lucy's research group has been working with aerodynamicists as well as structural dynamicists in considering upwind versus downwind as well as two- versus three-bladed configurations. (Most current commercial wind turbines are 3-bladed upwind turbines.)
Blades for upwind turbines must be kept very stiff (and hence massive and expensive) to avoid tower strike.
Downwind configurations, where the rotor is rotated 180 degrees from the standard upwind configuration,
allow for much lighter weight and less expensive blades.

99+% of current offshore wind turbines are shallow-water fixed bottom wind turbines where the turbines are built all the way to the sea bed.
For water depths greater than about 60 m, however, it doesn't make economical sense to build the wind turbines all the way down to the ocean floor.
Here it will be much more economical to use floating wind turbines and several floating platform concepts are being studied.
The majority of offshore wind resources is over deep water. When you have a floating wind turbine, both the wind and waves can cause oscillations … and you need to make sure to try to keep the wind turbine upright … and there are many challenging control issues.
Lucy's group is working with aero, structural, and hydro-dynamicists to design lighter weight and less expensive floating platforms,
while ensuring the controllers can maintain stability of the floating turbines.

Extreme-scale wind turbines and floating wind turbines increasingly require a control co-design approach, where the system design and control design are performed in a more integrated fashion. And Lucy's group has been working with aero, structural, and hydro-dynamicists to design and control novel wind turbine concepts, Lucy's group has been developing automated controller tuning methods to enable faster controller designs for the many variations of wind turbine configurations that they want to consider.

Finally, Lucy's group is also developing distributed control methods for coordinating the control of wind turbines on wind farms to better maximize power capture across the wind farm and minimize structural loads. All of her group's research is highly interdisciplinary with aero, structural, and hydro-dynamicists as well as atmospheric and oceanic scientists (to better understand wake formation and wave characteristics).

Required for Application 1/3

PLEASE SUBMIT ONLINE (7 items):

- 1. the university application.

- 2. U.S. $80 application fee (credit card payment). This fee must be received prior to our committee evaluating your application for potential admission. ($60 for U.S. citizens, greencard holders and refugees seeking asylum in the U.S.—less processing than for overseas transcripts)

Required for Application 2/3

- 3. CV or resume

- 4. Statement of purpose, 500-750 words, detailing which faculty you want to work with, your enthusiasm for your academic focus, how you came to enjoy EE studies, which projects you have done, which experiences shaped you as a student, as a professional, as an individual and what your goals are.
- 5. Scans of ***un***official transcripts and proof of degree/s earned from each and every university in any country at any time). You need submit official ones electronically, only if and when ultimately admitted. *Our admissions office experts will convert your gpa. You need* ***not*** *do so via WES nor any other group*.

Required for Application 3/3

- 6. **Three** letters of recommendation. Ideally, each letter-writer should submit via the online portal for your university application (each writer will be e-mailed a link by the software).

- Letter-writer didn't receive the link? Writer should check their spam box, first. Not in spam? You (the student/applicant), please contact **gradadm@colorado.edu** and have them assist you.

- 7. We require unofficial exam scores prior to admission. ETS must submit these to the 4841 institutional code. (TOEFL (score 7.0)or IELTS (90+) or DuoLingo (120+) required from most countries; exempt countries at: https://www.colorado.edu/graduateschool/admissions/prepare-apply/international-students/english-proficiency-requirements

When to Expect your Decision for Fall 2025

Review begins in February and decisions **are issued prior to 30 April**, after careful, side-by-side comparison of all applicants.

Decisions are made after careful consideration of all, side by side, over a period of time, and are not necessarily issued in the order an application was received.

GRE scores: *Not* required for Fall 2025 applications; our committee cannot even see submitted scores.

~~**GRE COPIES VS. OFFICIAL SCORES?**~~

- ~~We require official scores prior to admission—these must be sent by ETS to institutional code 4841. (the 1201 or 1203 deptl code is often requested by ETS, but we only obtain our scores via the 4841 instl code).~~

- ~~These take about two weeks to reach us after your exam date and submission by the testing service….~~

- ~~**Your GRE VQA must be no lower than 139 / 159 / 3.0+ , although we prefer 150/162/4+ and must be no older than 5 years. These scores must be sent by ETS, not by you.**~~

TOEFL / IELTS

The following English exams are only pertinent to visa students and must not be older than 2 years:

- We prefer internet-based score of 100+ We can flex into the ‘90s.
- Can be ***un***official TOEFL, IELTS, Duolingo; Official due by 01 July if admitted
- Institutional code: 4841
- Departmental code: 66
- Alternately, IELTS scores must minimally be 7.0 (or, Duolingo of 120)
- **You need *not* take the TOEFL (nor IELTS, nor Duolingo) if you provide an official transcript showing 1+ academic years' studies in the U.S., Canada, Australia, India, Nigeria, or in another country in which English is one of the official languages; official language counts—not the language of instruction.**

Software issues while applying?

- Please contact **gradadm@colorado.edu** with any software / technical support questions (especially regarding whether your payment went through, or re: letter writers who occasionally have trouble accessing links to submitting online letters).

GRADE, POINTS, GPA FIELDS IN THE UNIVERSITY APPLICATION SOFTWARE?

- The software is programmed more for U.S. gpa's, point systems, etc. You can leave these portions blank if you are filling in information from a non-U.S. university (but please ***do*** fill in names and places of your universities attended, if the software permits it).

- Our Admissions office will evaluate your transcripts, and are expert in doing so for the transcripts of hundreds of universities from throughout India, China and *many* other countries.

UPDATES ON STATUS?

- Please visit the status page for updates regarding your application.

Financial Support

- You will automatically be *considered* for potential aid--though it can be competitive to ultimately *receive* such aid. There is *not* any extra paperwork to fill out during the application process to be considered.

- Funding offers to Master's are made to *current* CU Boulder students who fill out a form dedicated to this, after completion of their first semester in the program. Not all are given employment, who apply. There are also other campus jobs you can do during first semester and beyond. Most rewarding are summer internships and Fall and Spring internships (= co-ops).

JOB PROSPECTS AFTER GRADUATION

In the 28 years I have worked here, our job placement has bee nearly 100% *for students who perform well, academically*. The students who graduate from our ECEE department *with sufficiently high grades* are in high demand and usually receive multiple job offers, locally, in Colorado, in Silicon Valley / California, nationally, and internationally, as they near their official graduation.

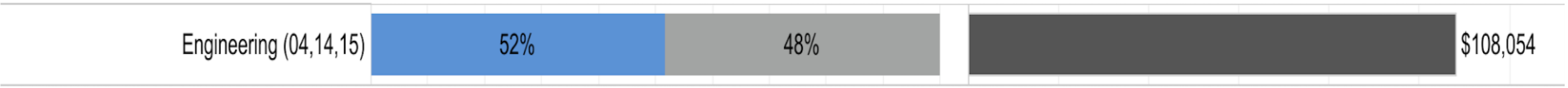
Our education is rigorous and you gain satisfaction from working through challenging individual and group projects. Many of our faculty have strong ties with industry and with industrial advisory boards that consult about the content of our courses.

That said, under the current economy, it can be more challenging.

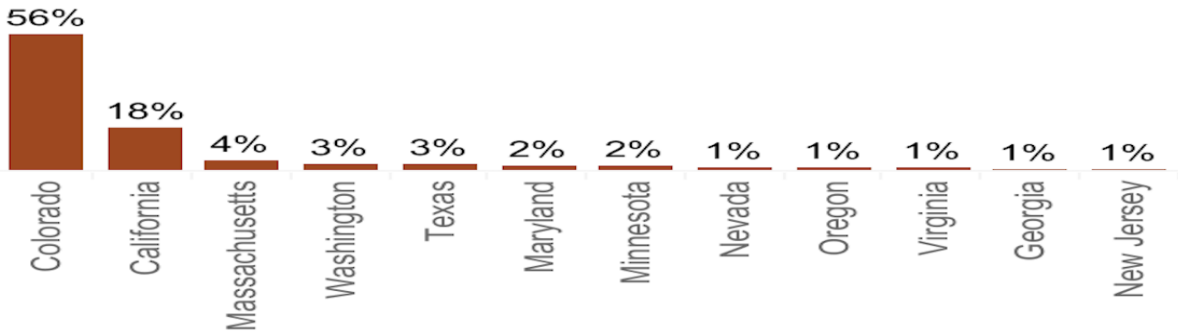
CU Alumni by Field of Study (2-Digit CIP Rollup)

Display
Field of Study (2-Digit CIP Rollup)

Display
Avg. Age Adjusted Earnings ($)



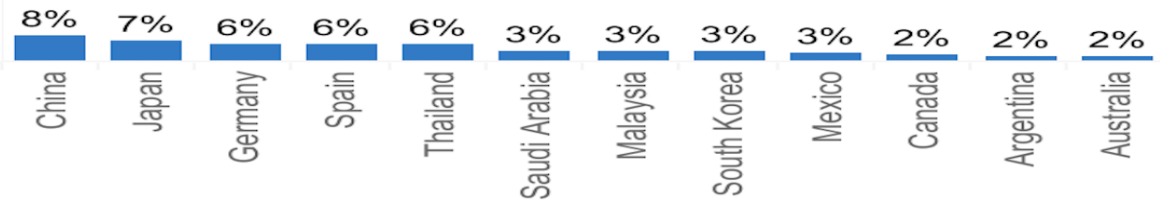
Top 12 States Employing Alumni



Top 12 Countries Employing Alumni

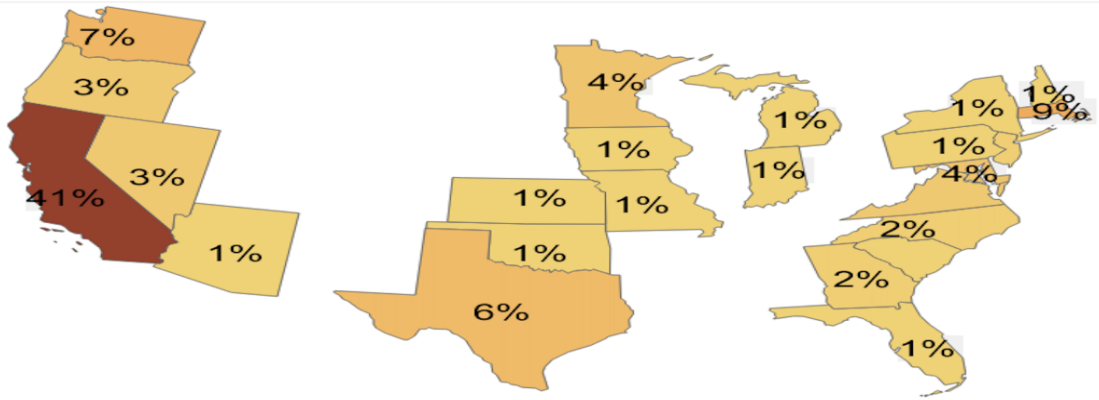
*% calculated for alumni employed outside of U.S.

Outside the U.S.	4%
In the U.S.	96%



U.S. Employment Outside of Colorado

*% calculated for alumni employed in the U.S. outside Colorado



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Career Information for Graduate Alumni 1997 - 2017

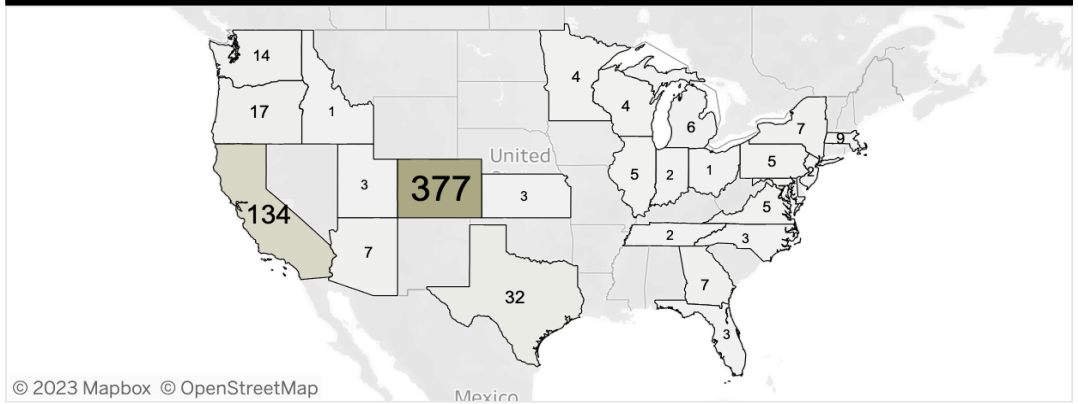
Degree Level: *Masters* School/College: *Engineering* Area of Study: *Electrical Engineering*

Estimated Salary by Years From Graduation

Select to filter rest of page (double click highlighted area to remove filter)

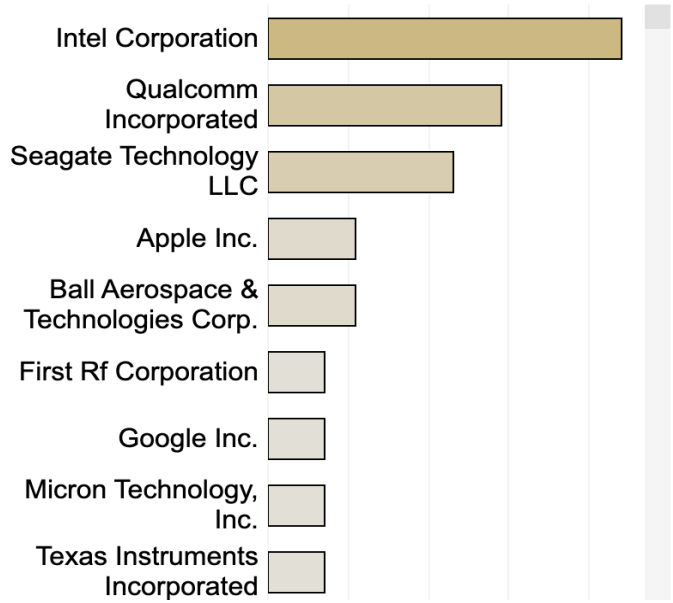
1-5 years from graduation	$95,072
6-10 years from graduation	$108,445
11+ years from graduation	$106,125

Employer Location by State

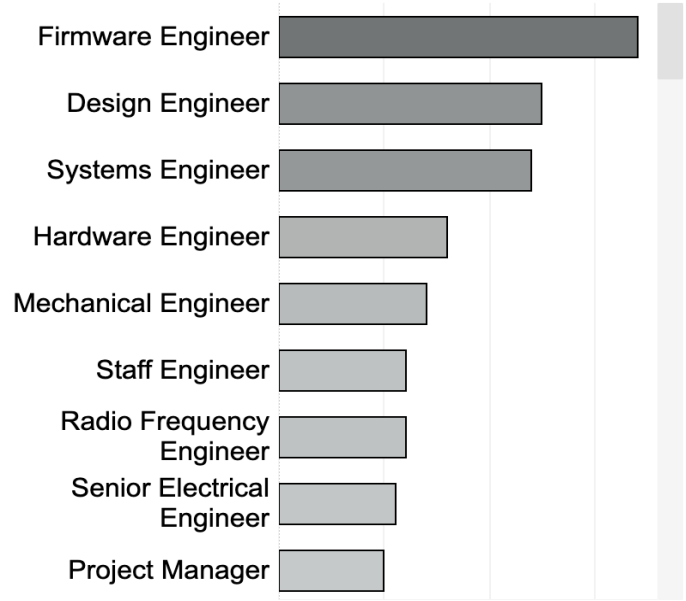


Top Employers

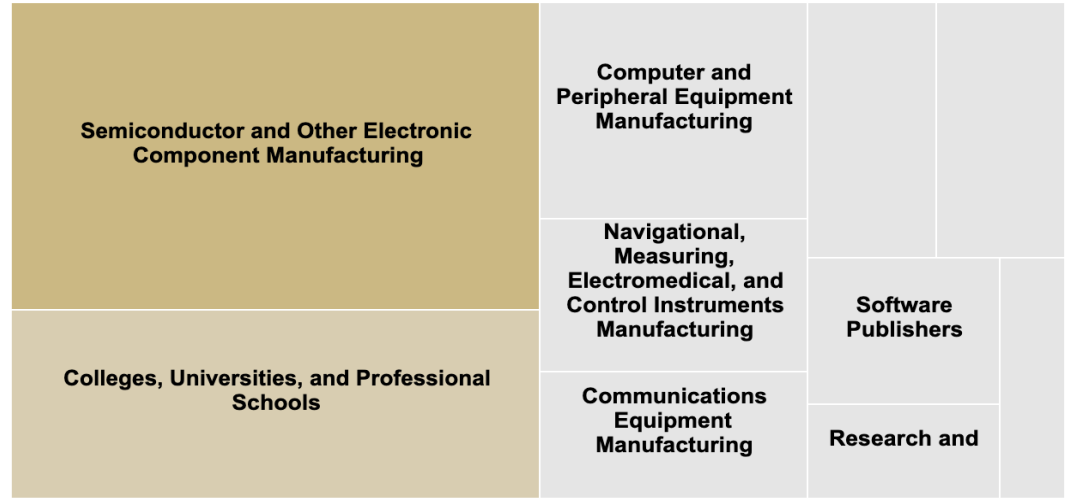
beyond University of Colorado



Top Job Titles



Top Industries



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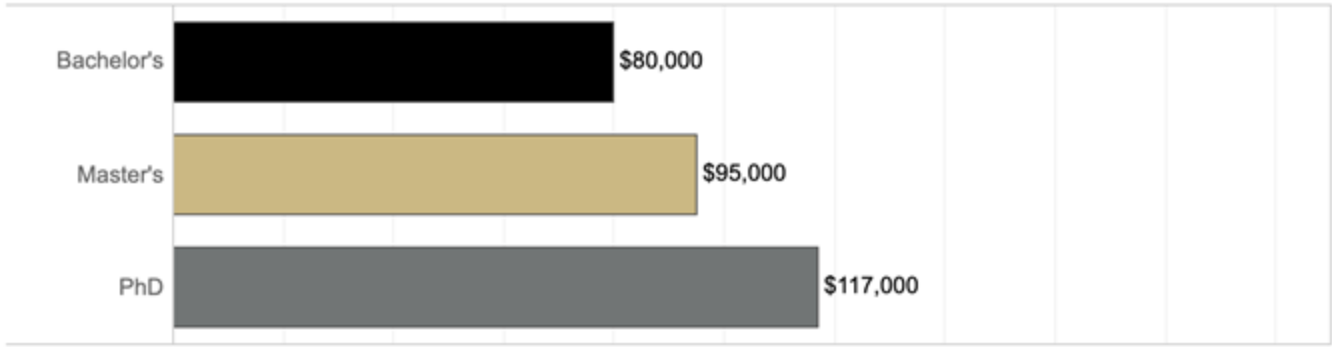
Graduate Destinations Survey: Salaries

Viewing for: School/College: **Engineering**; Major: **Electrical Engineering**

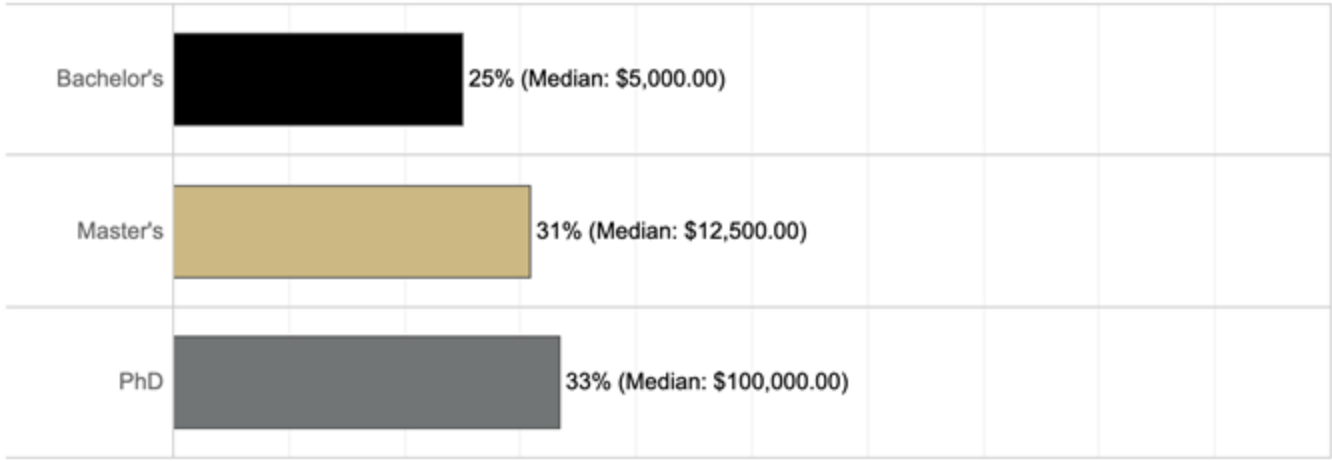
Alumni Salaries: Median

**For those employed full-time and who report a salary greater than $0*



Signing Bonuses: Percent Alumni Receiving Bonuses, Median Bonus

**For those employed full-time*



Power Electronics Salaries 2023

https://www.colorado.edu/ecee/academics/graduate-programs/professional-masters/power-electronics. (Embedded Systems Engineering range even higher)

Program Flyer | Program FAQs

Modern, High-Quality Power Electronics Curriculum

- 30-credit hour MS degree, through core course and flexible electives, including a 9-credit hour graduate certificate
- Hands-on experience through two dedicated power electronics laborartory courses
- Estimated tuition cost for Professional Master's in Engineering

Teaching and Research Opportunities

- Opportunities to gain experience through Graduate Learning Assistantship positions
- Course Facilitator positions available for distance learning through the MS-EE on Coursera
- Research opportunities through Independent Study and hourly positions

Outstanding Internship and Career Opportunities

- Gain competitive internship positions, usually available during summer
- Job opportunities with leading companies in power electronics, electrified transportation, renewable energy and semiconductor industries
- Typical salary range for our graduates: $95,000 - $153,000, with a median of $130,000

AFTER YOU ARE ADMITTED:

- We have excellent campus and College of Engineering resources that provide career fairs with industry recruiters, skills training in resume writing, interviewing, dining etiquette specific to interviews, intercultural business practices, salary negotiation...and that assist students with visas for international conference attendance, study and/or work.

- We have a beautiful campus, Olympic-quality student recreation center, dozens and dozens of academic, social, special interest professional societies, clubs, 10 minutes' walk to miles and miles of clean, hiking/biking paths, beautiful mountains, streams, as well as internationally esteemed research centers including NIST, NCAR, etc. where many of our PhDs and MS students do research. Boulder has the highest population of PhDs in the United States and has been ranked the best quality of life city in the U.S.

Extracurricular activities; realize your dreams, change the world, and augment your CV

- **The Idea Forge:** Meet other students, interdiscipinarily assisting each other to build funded, individual, and cooperative creative engineering projects. Come make your your long-dreamed blue prints into a reality! https://www.colorado.edu/ideaforge/

- Environmental Advocates: DO something to help by joining **Mission Zero**: https://missionzero.io/ . Pro-actively heal the environment through your engineering skills!

- **Cubesat**'s where it's at: Use your engineering skills to build and launch an actual satellite for terrestrial observations https://www.colorado.edu/project/maxwellcubesat/

Colorado: Very Healthy, Safe, Clean State

- Colorado is almost the healthiest state in all the United States, historically, and our campus is one of the healthiest, as well, with a very nutrition-conscious, frequent-exercising, meditating, yoga-practicing population. Ayurvedic care, acupuncture and other preventative health care have been in place for many, many years; we have outstanding physical therapists and Olympic-quality sports medicine doctors (and campus facilities), very wide, open spaces with clean air and clean water. During covid, it was very easy to maintain healthy amounts of space between individuals and still enjoy thousands of square kilometers of parks, biking and hiking paths....Our campus pro-actively esteemed health for all of us and mandated quarantines prior to the State doing so, and our State also did so earlier than other states in the US.
- I (Adam) raised my child here (as have most of our campus staff and faculty—there are several newborns among our staff and faculty in the past few months). As a parent of a college-age daughter, (and, having been very fortunate to have lived, worked and traveled in a large number of countries including much of Southeast Asia for many years, as well as to most of the 50 U.S. states....Lori, our PhD advisor, has traveled to even more countries than I), I can attest that Boulder is one of the safest, healthiest and cleanest places in the U.S.—and it is also one of the most welcoming of international guests.

Quality of Education, Warmly Welcoming to Everyone

- **Quality of Education and Openness to Everyone:**

- I (Graduate Advisor, Adam Sadoff) have worked in our dept for 28 years (and one of our faculty has worked in our dept for 65 (yes, sixty-five) years, because that faculty member and I truly believe in the quality of education we provide our students—and especially our visa students, who receive outstanding support and warm welcomes, campus-wide. Our International Students and Scholars Services Center (ISSS) is a **fantastic resource for our visa students.** Boulder also has a disproportionate number of very well-traveled U.S.-born students, staff and faculty (many also were born, overseas, themselves) who are culturally wide-open and welcoming. I was warmly welcomed in every country and I am happy to return the favor—to **all** our visa students, from whichever countries you are coming from.
- And, to extend the distances of those 'well-traveled': Our campus has produced more astronauts than nearly any other, and has had one of the highest numbers serve in the Peace Corps started by President Kennedy in the 1960's.

More Questions?

PhD and Traditional Master's:

Lori.Meehan@Colorado.edu

Professional Master's

Adam.Sadoff@Colorado.edu

We are Colorado!

Lori Adam