Industrial Advisory Board Meeting
Fall 2018

Prof. Tony Maciejewski
Department Head
Electrical and Computer Engineering
Colorado State University
Agenda

• Department Update
• Faculty Spotlight
• Guest Speaker: Cultivating Diversity and Inclusion in ECE
• Breakout Session: Partnering with Industry to Shift the Culture around Diversity and Inclusion
• Lunch and Student Presentation
• Woodward Tour
• Social
Department Update
View Presentation Online

URL:
www.engr.colostate.edu/ece/industry/industrial_advisory_board.php

-or-

www.engr.colostate.edu/ece → Industry → Industrial Advisory Board

Presentation Location:

- Related Links → Meeting Presentations → Fall 2018
Welcome Guests

- **Susan Benzel**, Scott Scholars Mentor
- **Agnieszka Miguel**, ECE Department Chair, Seattle University
- **Ginger Morehouse**, WSCOE Development Director
- ECE student participants
Service Recognition

• Chuck Quire – 10 years
#FlashbackFriday
What’s New in ECE
ECE Faculty Excellence

- 26 faculty
- More than 40% IEEE Fellows
- Three UDPs, One UDPS
- ECE is a Top Ten Technology Producing Department at CSU
  - More than 65 technologies disclosed to CSU Ventures between 2012 and 2018
  - ECE inventors are on approximately 35% of CSU’s issued patents since 2012
Meet Our Newest Faculty Members

Mahdi Nikdast
Assistant Professor

Ryan Kim
Assistant Professor
ECE Contributes to Soaring CSU Research

Exemplary work cited by CSU VPR:

• $1M Keck grant for advanced nanoscale electronics
  Menoni, Rocca, Marconi

• $8.2M NASA award for a small satellite TEMPEST-D
  Reising, Chandra
Our Latest Fellow Award

Chandra
International Union of Radio Science
New Investigator Awards

Prof. Jesse Wilson
Melanoma Research Alliance and Boettcher
CSU ECE Involvement with ECEDHA

• ~90% of accredited ECE departments are represented in ECEDHA

• Tony
  ECEDHA President

• Andrea and Alauna
  Communications Team

2018 ECEDHA Conference
Notable Publicity
ECE Faculty Demonstrate Micro-Scale Nuclear Fusion with Record Efficiency

- Work inspired visit from U.S. Senator Bennet

- Overwhelming popularity on Reddit Science

- 47,070 unique page views on CSU Source
  - Most popular story on WSCOE Source in 2018

Research was published in *Nature Communications*
IEEE President’s Forum Held at CSU

• National event with live streaming Q&A with IEEE leadership

• Richard Toftness spearheaded event and advocated for CSU venue
CSU Satellite Peers Inside Hurricane Florence

Project has garnered attention from the community and NASA
Using Virtual Biopsies to Improve Melanoma Detection

Top 5 story on WSCOE Source in 2018
ECE Project Featured in CSU Flagship Magazine

Research aims to tackle air quality
Research to Improve Commutes in Fort Collins

Prof. Chong is part of interdisciplinary partnership with the City
New Alumni-Funded Scholarship

Susan (BS ‘88) and Randy (BS ‘88) Benzel Scholarship

Inaugural Recipient
Gillian Fahey

Colorado State University
Department of Electrical and Computer Engineering
Results of 2018 Best Paper Contest

Congrats to the Canine Exoskeleton team!
ECE by the Numbers
## Proposal Activity FY18

### 26 ECE Faculty

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposals submitted*</td>
<td>69 (down from 100 last year)</td>
</tr>
<tr>
<td>Total amount of proposals</td>
<td>$47.5M</td>
</tr>
<tr>
<td>Highest proposal amount w/ECE as lead</td>
<td>$1.2M to NSF</td>
</tr>
<tr>
<td>Highest proposal amount w/ECE as collaborator</td>
<td>$3.7M to HHS-NIH</td>
</tr>
<tr>
<td>Primary funding agencies</td>
<td>NSF, NIH, DOD, DOE, NASA, DHS, DOJ</td>
</tr>
<tr>
<td>Collaborators</td>
<td>Bioagricultural Sciences &amp; Pest Management, Chemical &amp; Biological Engineering, Atmospheric Science, Civil &amp; Environmental Engineering, Mechanical Engineering, CIRA, Biomedical Sciences, Biochemistry &amp; Molecular Biology, Chemistry, Physics, Statistics</td>
</tr>
</tbody>
</table>
Share of Global R&D

Share of Global R&D of Selected Countries 2000-2016

Source: Congressional Research Service, Global Research and Development Expenditures Fact Sheet
R&D Expenditures of Selected Countries

Growth in R&D Expenditures for Selected Countries, 2000-2016

Source: Congressional Research Service, Global Research and Development Expenditures Fact Sheet
Teaching Productivity
ECE Student Credit Hours

Credit Hours

Undergrad  Grad

ECE Undergraduate Enrollment

Number of students

FA11  FA12  FA13  FA14  FA15  FA16  FA17  FA18

Undergraduate Primary Majors (includes BME)
International Grad Enrollments Fall Again

Figure 6. Changes in graduate applications by degree level, Fall 2007 to Fall 2017

% Change, 2016 to 2017
-2.0%  
-1.8%  
-1.8%

Average Annua % Change, 2012 to 2017
2.0%  
2.1%  
1.0%

Average Annual % Change, 2007 to 2017
5.2%  

Note: Master’s/Other includes applications to graduate-level certificate and education specialist programs.

Source: Inside Higher Ed
Rapid Growth in Foreign-Student Work Program

- Participation in program has grown by 400 percent in eight years
Freshman Enrollment

- FA13
- FA14
- FA15
- FA16
- FA17
- FA18

- Biom/EELO
- Biom/EE
- CpE
- EE

Number of students
CSU Engineering Enrollments

Data does not include biomed dual degrees
National Student-Faculty-Ratios (2017)

- Numbers represent the number of students for each faculty member
- While Computer Engineering has a high ratio within “B.A.” and “M.A.” schools, it also has the lowest ratio within the “Other” school category

Source: ASEE Databytes
ECE Freshman Enrollment: Colorado Institutions

- University of Denver
- University of Colorado Denver
- Colorado School of Mines
- University of Colorado Boulder
- University of Colorado Colorado Springs
- Colorado State University

*Source: ASEE - does not include biomed dual degrees
ECE Undergraduate Enrollment: Colorado Institutions

*Source: ASEE - does not include biomed dual degrees*
National Engineering Undergraduate Retention

Figure 1: Persisted to 2nd Year

Figure 2: Graduated within 6 Years

Persistence and graduation to the second year has increased over the last survey cycle

Source: ASEE Databytes, July 2018
ECE Freshman Retention to 2\textsuperscript{nd} Fall

Cohort Size of First-Year ECE Students

Persistence Rates of First-Year ECE Students Through 2\textsuperscript{nd} Fall

- Dot com bubble
- "The World is Flat"
- The Great Recession

Persistence Rates Within Department by Cohort Department and Cohort Term
ECE Freshman Retention to 6th Fall

Cohort Size of First-Year ECE Students

Persistence Rates of First-Year ECE Students through the 6th Fall

Persistence Rates Within Department by Cohort Department and Cohort Term
Nontraditional Undergrads in ECE

*Does not include Biomed dual majors*
First-Generation Undergrads in ECE

*Does not include Biomed dual majors*
International Students in ECE at CSU

Number of Students

<table>
<thead>
<tr>
<th>Year</th>
<th>Undergraduate</th>
<th>Graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA08</td>
<td></td>
<td></td>
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<tr>
<td>FA09</td>
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<tr>
<td>FA17</td>
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<td></td>
</tr>
<tr>
<td>FA18</td>
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</tbody>
</table>

Color Coding:
- **Green** indicates Graduate students.
- **Gold** indicates Undergraduate students.

Legend:
- Undergraduate
- Graduate
Percent of International Degrees Awarded

<table>
<thead>
<tr>
<th>Year</th>
<th>Ph.D.</th>
<th>MS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012-13</td>
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<td></td>
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<td>2013-14</td>
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<td>2014-15</td>
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<td>2015-16</td>
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<td></td>
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<tr>
<td>2016-17</td>
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<td></td>
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<tr>
<td>2017-18</td>
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<td></td>
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</tr>
</tbody>
</table>
Engineers as a Percentage of All Occupations by State

Source: NSF S&E Indicators Report, 2018
Histograms do not display states with extreme values. Please consult the data tables for exact indicator values for each state. State positions on the histogram are based on unrounded values of the indicator and may not always match the rounded values displayed in the table.

Source: NSF S&E Indicators Report, 2018
More Top-Performing CEOs Have Engineering Degrees Than MBAs

For the second consecutive year, *Harvard Review’s* annual “top-performing CEOs around the globe” found that engineering degrees are slightly more prevalent among CEOs than finance- and strategy-focused MBAs.

*Source: Washington Post, 10/22/18*
Impact of Professional Formation in ECE

100% of ECE graduates found employment related to their major last year.

$73,400 average starting salary for ECE graduates (COE average is $61,017; CSU average is $47,039).

325 hours industry professionals spend with our students through the Engineer in Residence program.

Source: CSU First Destination Study, 2017
Current Status of RED Project

• Delivering second year sophomore-level material

• Third year of junior-level LSMs and KIs

• Conducting analyses, submitting to conferences and journals, and continuing data collection

• Focusing on broader dissemination and continuation grant from NSF
  – Diversity will be component of follow-on grant
  – Professionalism advisory committee will play a role
Fall Action Items
Update on Fall Action Items

• **Action item:** Share an update on ECE branding initiative
  – **Status:** Framework unveiled at ECEDHA Conference in March; example to follow
We typically use a print ad as a foundation for creative work — knowing we can translate many components to other formats and channels. This particular framework is composed of 7 key elements.

- Impact image
- Duality headline
- Punch bar
- Support copy
- Logo
- Call to Action Area (can vary by school or a campaign URL can be created)
- Universal Tagline
BRINGING LIGHT TO MELANOMA DETECTION

Melanoma imaging and detection without a biopsy
- Brought to you by ECE

We all like to have fun in the sun. But too much exposure could cause cancers such as melanoma. Electrical and computer engineering researchers at Colorado State University understand the importance of identifying melanoma in its early stages. We are developing a handheld virtual biopsy tool to make melanoma detection faster and cheaper, eliminating the need for the dreaded scalpel. Thanks to ECE, the future is bright. More at engr.colostate.edu/ece/the-future-is-what-we-do.

— ECE - THE FUTURE IS WHAT WE DO.
Action Items Related to K-12 Outreach

• Create targeted programs that emphasize 1-on-1 relationships

• Create opportunities to expose prospective students to real engineering

• Bolster outreach to H.S. counselors

• Invite middle and high school students to on-campus engineering events

• Consider partnering with industry to attract high school students to ECE
# Status of K-12 Outreach Action Items

<table>
<thead>
<tr>
<th>New K-12 Outreach Team (led by Olivera Notaros)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 students ranging from freshmen to seniors</td>
</tr>
</tbody>
</table>

Focus areas: communication with high schools; math; analog circuits; and digital circuits

**Goals:**
- Partner with industry and pursue funding through IEEE
- Target and recruit undeclared engineering students at CSU
- Recruit H.S. students through 1-on1 partnerships with local high schools (currently meeting with students at Poudre H.S. on a weekly basis)
- Produce relevant content/videos for prospective students
### Planned Initiatives for 2018-19 (led by Karen Ungerer)

<table>
<thead>
<tr>
<th>Initiative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosting High School Counselor Day</td>
</tr>
<tr>
<td>Developing new tailored events with key high schools <em>(hosted 20 middle and H.S. students this week from Compass)</em></td>
</tr>
<tr>
<td>Leveraging College of Engineering recruitment efforts and piggybacking on their events</td>
</tr>
<tr>
<td>Inviting high schools to E-Days, sophomore project demos, and Dumpster Dive</td>
</tr>
<tr>
<td>Developing framework for ECE summer camp in 2019</td>
</tr>
<tr>
<td>Exploring feasibility of including H.S. students in virtual internship program</td>
</tr>
</tbody>
</table>
Context for Diversity and Inclusion Discussions
Bachelor’s Degrees to Women (2017)

- Up from 19.9% in 2015

*ASEE by the Numbers*
Bachelor’s Degrees to Women (2017)

Percentage of Bachelor’s Degrees Awarded to Women by Discipline: 21.3% of Total

- Bio & environmental disciplines have largest share of women

*ASEE by the Numbers
Bachelor’s Degrees to Women (2017)

Percentage of Bachelor’s Degrees Awarded to Women by Discipline: 21.3% of Total

- Mechanical, electrical, and computer still unacceptably low

*ASEE by the Numbers*
Women’s Share of S&E Bachelor’s Degrees (2000-2015)

Source: NSF S&E Indicators Report, 2018
Women in Engineering at CSU (FA18)

Undergraduate:
- Biomed Dual Degrees: 31%
- Intra-College: 5%
- ECE: 15%
- CEE: 29%
- ME: 15%

Graduate:
- ECE: 19%
- ATS: 18%
- CBE: 3%
- BME: 6%
- Intra-College: 12%
- ME: 6%
- CEE: 36%
Women in ECE at CSU

<table>
<thead>
<tr>
<th>Year</th>
<th>Number UG Women</th>
<th>Percent UG Women</th>
<th>Number GR Women</th>
<th>Percent GR Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA14</td>
<td>30</td>
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<td>FA18</td>
<td>35</td>
<td>25</td>
<td>15</td>
<td>13.2</td>
</tr>
</tbody>
</table>

*Includes Biomed dual degrees
Engineering Faculty Gender Gap

U.S. Engineering School Faculty Gender Ratio, 2017

Source: ASEE Databytes
Colorado is Forecast to Grow, Future Students Growing More Slowly
A Closer Look at Future Students

Population and Growth Rates of 17 and 18 Year-Olds

Population and Growth Rates in the 17-25 Year-Old Cohort
Future Students will be Increasingly and Ultimately Majority Hispanic

Share of 0-17 Population by Ethnicity
Historically, Less Economic Capacity for Hispanic Families

Note: Median household income data are not available prior to 1967. Implementation of 2010 Census population controls began in 2010. For information on recessions, see Appendix A.

What Will be Impact of Less Homogeneous Colorado Population?

Share of Colorado Population Growth from Migration (30 out of 46 years greater than 50%)

Share of Growth From Domestic Migration Among Growing States with Positive Domestic Migration (2015)
Diversity and Inclusion at CSU

College of Engineering
• Melissa Burt, new Assistant Dean for Diversity & Inclusion
• Susan Benzel emphasizing diversity and inclusion in new role
• Becki Atadero leading diversity initiative

Computer Science
• New department head has vision to dramatically increase diversity

University
• Creating Inclusive Excellence Program
• Faculty Institute for Inclusive Excellence
• Social Justice Leadership Institute
• Customized training for departments

Melissa Burt
Assistant Dean for Diversity and Inclusion