Welcome New Members

- Kin Chan, Keysight Technologies
- Daniel Guerrero, National Instruments
- Matt Hilt, Numerica
- Mike Stiles, Avaya Communications
- Ron Vaughn, NVIDIA
10 Years of Service – Thank You!

- Jim Greener
- Lance Guymon
- Dana Kirchmar
- Fernando Tomasel

Fernando, Student Advising Day - 2005
Jim, Circa 2005?
Agenda

• Department Update
• Engineer in Residence – Pilot Program with IEEE
• Industry Spotlight: Keysight Technologies
• Faculty Spotlight: Professor Tom Chen
• Break
• RED Professional Formation Thread
• Breakout Session: IAB Input on Professional Formation Thread
• Report Results of Breakout
• Lunch and Senior Design Presentations
ECE Faculty Highlights

- 28 faculty (w/one on transitional retirement)

- High percentage professional awards
  - More than 40% of ECE faculty are IEEE Fellows

- Top 10 technology producing department at CSU
  - Nearly 40 new technologies disclosed to CSU Ventures between 2012 and 2015

- Three CSU University Distinguished Professors (17 total)
  - No other departments boast a higher number of UDPs
New Faces in ECE

• Jesse Wilson, new associate professor
• Katya Stewart-Sweeney, new academic advisor starting November
Faculty Recognition in the Field

Fellow Awards

• Morton (IEEE, ION)
• Yang (IEEE)

IEEE

• Notaros, 2015 Undergraduate Teaching Award
• Chong, President of IEEE Control Systems Society
• Pasricha, Excellence in Scalable Computing Award
• Suryanarayanan, Outstanding Young Engineer – Power & Energy Society

ASEE

• Notaros, ECE Distinguished Educator Award
Press About New Grants

- Open-ocean atmospheric research (Chandra)
- “Big data” graduate program (Chen)
- Preparing the next generation of STEM teachers (Chong, De Miranda)
- CSU/CU collaboration to purchase state-of-the-art HPC system (Siegel, Chong)
- Revolutionizing Engineering Departments (Maciejewski, Chen, De Miranda, Notaros)
Lisa and Desi Rhoden Professorship in Electrical & Computer Engineering

- First-ever endowed professorship for ECE
- Tool to attract, retain faculty
- Supports faculty, as well as salary or tuition for students
- Rhodens are significant alumni donors with $7M bequest
- Couple recently named 2015 Distinguished Alumni for College of Engineering

Lisa Rhoden
B.S.E.E. ’84

Desi Rhoden
B.S.E.E. ’83, M.S.E.E. ’84
Results of Best Paper Contest

• Winner is Social Robotics Platform team
  – Thanks for your continued support of the contest!
COE Research Expenditures
FY15
COE Student Credit Hours (14-15)

- ME: 36%
- CEE: 29%
- CBE: 9%
- ECE: 20%
- ATS: 5%
- Intra-College: 1%
Undergraduate Degrees Awarded

Number


BSCpE BSEE
National Enrollment Trends by Discipline
(’04-’14)

- Mechanical Engineering
- Electrical/Computer Engineering
- Civil Engineering
- Chemical Engineering
- Biomedical Engineering
- Environmental Engineering
- Engr. Science and Engr. Physics
ECE Freshmen Retention Rates

Cohort Size of First-Year ECE Students

Persistence Rates of First-Year ECE Students through the 2nd Fall

Persistence Rates Within Department by Cohort Department and Cohort Term
ECE Freshmen Retention Rates

Cohort Size of First-Year ECE Students

Persistence Rates of First-Year ECE Students through the 5th Fall

Persistence Rates Within Department by Cohort Department and Cohort Term
ECE Freshmen Retention Rates

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
Retention Programs

- New student projects laboratory w/3D printers
- Engineer in Residence Program
- Ladies’ Coffee Club
- Social media coordinator
- Free tutoring
- Community-building activities
  - ECE Study Nights
  - Ice Cream Social
ECE Colorado Freshmen Enrollment: Colorado Institutions (2010-2014)
ECE Colorado Undergraduate Enrollment: Colorado Institutions (2010-2014)
Top ECE Institutions & Peers

US News & World Report Top Institutions
- Massachusetts Institution of Technology
- Stanford University
- University of California - Berkeley
- Georgia Institute of Technology
- University of Illinois - Urbana-Champaign
- University of Michigan - Ann Arbor
- California Institute of Technology
- University of Texas - Austin
- Purdue University
- Cornell University

CSU Peer Institutions (as ID’d by CSU BOG)
- Iowa State University
- Kansas State University
- Michigan State University
- North Carolina State University
- Oklahoma State University
- Oregon State University
- Purdue University
- Texas A & M University
- University of California, Davis
- University of Illinois, Urbana-Champaign
- University of Tennessee
- Virginia Polytechnic Institute and State University
- Washington State University
### ECE Freshmen Enrollment: CSU, Peers, & Top 10 USNWR Institutions (2010-2014)

<table>
<thead>
<tr>
<th>Year</th>
<th>CSU</th>
<th>Peer Institutions (Average)</th>
<th>TOP 10 USNWR (Average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>66</td>
<td>155</td>
<td>127</td>
</tr>
<tr>
<td>2011</td>
<td>60</td>
<td>165</td>
<td>126</td>
</tr>
<tr>
<td>2012</td>
<td>59</td>
<td>177</td>
<td>127</td>
</tr>
<tr>
<td>2013</td>
<td>69</td>
<td>173</td>
<td>126</td>
</tr>
<tr>
<td>2014</td>
<td>64</td>
<td>139</td>
<td>98</td>
</tr>
</tbody>
</table>

Legend:
- **2010**: Green
- **2011**: Purple
- **2012**: Blue
- **2013**: Red
- **2014**: Light Blue
ECE Total Undergraduate Enrollment: CSU, Peers, & Top 10 USNWR Institutions (2010-2014)
Graduate Degrees Awarded

- MS
- Ph.D.
- Online ME in ECE

Number

Full Year

2010-11
2011-12
2012-13
2013-14
2014-15
Women in Engineering (FA15)

Undergraduate
- Intra-College, 34%
- CEE, 25%
- ME, 22%
- ECE, 6%

Graduate
- AS, 15%
- CEE, 30%
- ECE, 28%
- BME, 7%
- Intra-College, 7%
- ME, 9%

Intra-College, 7%
CBE, 5%

BME, 7%
AS, 15%

ECE, 6%
CEE, 14%

Intra-College, 34%
CEE, 25%

ME, 22%
Career Outlook for ECE Grads

• For last decade, EE and CmpE are among top 10 majors in demand for B.S., M.S., and Ph.D. degrees

• 100% of ECE graduates had employment related to their major, the CSU average is 75%**

• ECE graduates earned the highest staring salaries in the College of Engineering**

*National Association of Colleges and Employers  Annual Job Outlook Reports
**CSU First Destination Study
Computer Engineering Median First Year Earnings by CO Institutions

In State 1st Year Earnings for Bachelor's Degree Completers in Computer Engineering, by Institution

The chart shows the top 10 Institutions

Earnings:
- 1st Year
- 5th Year
- 10th Year

- **Colorado State**: $66,654
- **Univ. of Den**: $60,998
- **CU-CO Springs**: $60,603
- **CU-Boulder**: $60,411

Source: COEdPays.org
Electrical Engineering Median First Year Earnings by CO Institutions

In State 1st Year Earnings for Bachelor's Degree Completers in Electrical, Electronics and Communications Engineering, by Institution

The chart shows the top 10 institutions.

Earnings:
- 1st Year
- 5th Year
- 10th Year

- Colorado State: $63,610
- Univ. of Den: $61,605
- CU-Denver: $60,586
- CU-Boulder: $59,443
- CU-CO Springs: $58,609

Source: COEdPays.org
Computer Engineering Median Fifth Year Earnings by CO Institutions

Source: COEdPays.org
Electrical Engineering Median Fifth Year Earnings by CO Institutions

In State 5th Year Earnings for Bachelor's Degree Completers in Electrical, Electronics and Communications Engineering, by Institution

The chart shows the top 10 Institutions

Earnings:
- 1st Year
- 5th Year
- 10th Year

- **Colorado State**: $77,186
- **CU-Boulder**: $73,776
- **CU-Denver**: $73,247
- **CU-CO Springs**: $70,534
- **Univ. of Den**: $69,203

Source: COEdPays.org
Status of Proposal for M.S. and Ph.D. in Computer Engineering

• Phase I under review

• Requested resources
  – New faculty lines to support growth
  – New graduate advisor
  – Recruitment funding
  – Office and lab space for new faculty (no equipment)
  – GRA and GTA lines
Update on Spring Action Items

• **Action item:** Continue to emphasize importance of the elevator pitch and being able to explain WHY design projects are important.
  – **Status:** This remains a priority. Ed and Susan continue to help senior design students. Professional Formation efforts should help this effort as well.

• **Action item:** Facilitate interaction with the College of Business to help teams pitch and market their projects.
  – **Status:** Pilot project begins in fall; market research instructor will identify and supervise COB students.
• **Action item:** Build on work with risk analysis; ask students to outline lessons learned as part of their projects.
  – **Status:** Requirement for new Open Option projects and ECE 202 projects. Senior design students discuss lessons learned in self- and team-evaluations at the end of the semester.

• **Action item:** Provide update on Engineer in Residence Program.
  – **Status:** Dick Toftness will share an update today.
About Us: NSF RED Team

• **PI**
  – Tony Maciejewski: Department Head

• **CoPIs**
  – Tom Chen: ECE Faculty Lead
  – Michael de Miranda: Engineering Education Expert
  – Zinta S. Byrne: Social Scientist

• **Senior Project Personnel**
  – Gerhard Dangelmayr: Department Head, Mathematics
  – Thomas J. Siller: Associate Dean for Academic & Student Affairs, College of Engineering
  – Branislav Notaros: Decorated ECE Educator, Professor
  – Alma H. Rosales: Industry Expert, Retired IBM Executive
Why Do We Want to Revolutionize Engineering Education?

Fundamental failures of current state:

- Unacceptable retention (particularly in ECE)
- Students aren’t making connections or seeing utility of their knowledge
- Graduates do not feel fully prepared for the profession, abandoning the discipline
Our Vision

• New breed of educators look at degree as an integrated system

• Multifaceted faculty weave threads throughout curriculum, while instilling deep knowledge of discipline

• Learning Studio Modules enable knowledge integration and connections to professional practice
RED Vision Structure

**THREADS**

- **Foundation**
  - math and science

- **Creativity**
  - research, design, optimization tools

- **Professionalism**
  - industry and professional formation, trans-disciplinary skills, entrepreneurship, communication

- **1st Year**
  - Integration Specialist for Transfers

- **2nd Year Studio**

- **3rd Year Studio**
  - Integration Specialists

- **4th Year**
Reimagining Roles

• Thread Champions
• Integration Specialists
  – Existing strengths, expertise leveraged to select faculty for new roles
Thread Champions

- **Foundations** – math, science
- **Creativity** – research, design, optimization tools
- **Professional Formation** – industry and professional formation, trans-disciplinary skills, entrepreneurship, communication
Integration Specialists

• Interweave threads
• Integrate anchoring concepts through Learning Studio Modules
• Use familiar applications, such as the smartphone, to hook students’ interest and show connections
Learning Studio Modules Enable Knowledge Integration, Connections to Professional Practice

CSU students from different concentrations

Transfer students from community college

Transfer students from other dept. from CSU

Transfer students from other universities
<table>
<thead>
<tr>
<th>ECE312</th>
<th>ECE332</th>
<th>ECE342</th>
<th>KIs</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex frequency response</td>
<td>CMOS Single-Transistor Circuits</td>
<td>High-Frequency Electromagnetics, Radiation</td>
<td>All 3 courses teach/review fundamental concepts during this period. No integration during this period</td>
<td></td>
</tr>
<tr>
<td>Infinite Impulse Response Filters</td>
<td>CMOS Differential Circuits</td>
<td>Propagation, Plane Electromagnetic Waves</td>
<td>All 3 courses continue to establish basic concepts in their own areas. It is still too early for integration</td>
<td></td>
</tr>
<tr>
<td>Discrete Transfer Function</td>
<td>CMOS Output Stage Driver Design</td>
<td>Wave Reflection, Transmission, and Refraction</td>
<td>Driver Design and Optimal Signals Transmission</td>
<td>This KI module aims at putting together the concepts in all three courses. Students will see why driver designs are delicate in order to achieve optimal signal transmission. The load matching is viewed as pole/zero cancellation (inversion function of the transfer function)</td>
</tr>
<tr>
<td>Finite Impulse Response (FIR) Filters</td>
<td>CMOS OTA and Opamp Design</td>
<td>Field Analysis of Transmission Lines and Waveguides</td>
<td>Differential and Unipolar Signaling and Its Impact on Transmission lines</td>
<td>When differential designs are taught in 332, students only see how they work inside circuits. They don’t see their impact at the system level. Looking at signaling modes within the context of transmission lines and signal transfer functions provides students insights on design choices, tradeoffs, and component non-idealities (op-amps).</td>
</tr>
<tr>
<td>Communication Systems</td>
<td>Circuit Frequency Response and Stability</td>
<td>Circuit Analysis of Transmission Lines in Frequency Domain, Transients</td>
<td>The System Level Perspective on Time-Domain vs. Frequency-Domain Analysis</td>
<td>This KI module is intended to provide students with a more holistic view of frequency-domain analysis and its applications to circuit designs. Any circuit can be viewed as a filter from frequency response point of view. Comparison of input/output signal transformations provides a different avenue for understanding circuits and systems.</td>
</tr>
<tr>
<td>Noise and Noise Analysis</td>
<td></td>
<td>A Peek into the Smart Phone Architecture</td>
<td></td>
<td>Now we are all the ingredients to look at the basic building blocks inside a smart phone. This KI module to building on all 3 courses to discuss antenna design, filter design, amplifier design, and digital signal processing methods used in modern smart phones</td>
</tr>
</tbody>
</table>
Next Steps

Project Year 1
• Preparation of junior year courses
• Baseline studies conducted for engineering education and organizational change

Project Year 2
• Preparation of sophomore courses
• First delivery of junior year courses in new model
• Second year conducting baseline studies on sophomore courses

Project Year 3
• First delivery of sophomore year in new model
Extending RED Beyond CSU

• Engineering departments at CSU are starting points
• Close collaboration with Colorado Community College System
• Share via relevant conferences
• Initial partnerships with Georgia Tech and Purdue
• Detailed communications plan
Engineer in Residence Program

Richard Toftness, IEEE High Plains Secretary
ENGINEER IN RESIDENCE

Where practice and theory come together
Engineer in Residence

- Brings practicing engineers of multiple disciplines together with students.
  - Students - What is it really like to work as an engineer?
  - Volunteers - Enjoyable contact with students, refreshing experience.
- 15 engineers have volunteered.
  - 2 females, 13 males
  - Waiting list developed
- On campus 9-12 and 1-4 Wednesday and 9-12 Thursday
- Encourage anytime contact with students and referrals.
- IEEE national has agreed to fund the program for this semester and next year.
Engineer in Residence

- Contact with students has been heavy some days and absent on others.
  - How do we engage more regularly with students?
  - What do we need to do to be more effective with students?
- Feedback from students has been very positive.
  - “You made a difference already”
  - “We have included three EiR’s with our project with different abilities”
  - 50% Career questions, 50% project questions
- Why?
  - Early in senior project cycle.
  - Unaware of why we are there.
  - Socially difficult
Engineer in Residence

- What’s next?
  - EiR lecture series
  - Greater visibility of projects
  - Patience

- What am I working on?
  - Extended ability list
  - Micro grants
  - Spend a day with an engineer
Faculty Spotlight

ECE Professor Tom Chen
Break
RED Professional Formation Thread
Alma Rosales
Professional Formation Thread Champion
The PLI was launched in 2007 to address industry concerns that engineers were technically competent, but lacked the professional skills required to succeed. The vision of the PLI was to ensure that all engineering graduates had the professional skills required to succeed.

- Provides sound leadership in professional, personal, and societal settings
- Applies advanced technical knowledge in order to identify and solve complex engineering problems
- Collaborates well in diverse teams due to understanding and appreciation of individual and cultural differences
- Works creatively to provide innovative engineering solutions
- Uses engineering skills to create positive global, economic, environmental, and social change
- Understands ethical responsibility and acts with integrity.
To graduate, an engineering student must complete 11 Professional Learning Institute sessions, each lasting an average of 1 ½ hrs.
Recent Input from Industry on Professional Skills Development for Engineering Students

TUEE (Transforming Undergraduate Education in Engineering)
- Communication skills
- Cultural awareness
- High ethical standards
- Critical thinking
- Ability to prioritize efficiently
- Project management
- Teamwork skills
- Entrepreneurship

ECE IAB
- Implement changes to senior design to emphasize communication skills (oral and written) and increase industry involvement
- Introduce design early in the curriculum to give students exposure to design, teamwork, project management, and testing. (student driven)
## Goals for Red Professional Formation Thread

### Currently- For all Engineering Students
- Provide knowledge (lectures)
  - *What do they know?*
- Lectures are primarily industry led
- Lectures exist separately from engineering curriculum; primarily after 5pm
- No learning modules available

### Vision for ECE Sophomore and Junior Year
- Provide knowledge and opportunities to practice skills, and assess performance.
  - *What can they do?*
- Continue industry involvement;
  - Enlist faculty to deliver and assess professional skills development
- Integrate professional skills development into engineering curriculum
- Provide Learning Studio Modules to faculty and students
Breakout Session

Challenge Questions

• Thinking beyond classroom lectures, what are your ideas for weaving professionalism throughout the curriculum?

• How can industry play a role in the Learning Studio Modules?

• What are your suggestions for assessing our professional formation activities?

Scope

• Communication
• Teamwork
• Ethics
• Cross-cultural adaptability
• Leadership
Report Results of Breakout

Facilitators: Alma Rosales and Lance Guymon
Lunch
Senior Design Presentations
Closing Remarks

Tony Maciejewski