TRITON DAY

UC San Diego
Congratulations!

You did it!
• Department Introductions
• Faculty Introductions
• Student Introduction
• Panel Discussion
• Q & A
Department Chair:  Professor George Tynan

Undergraduate Chair:  Professor Bob Bitmead

Undergraduate Academic Advising

Director of Student Affairs:  Zachary Dake

Academic Advisors

- Chad Baldwin (A-L)
- Nadia Familier (M-Z)

Intake Advisor:  Regina Ready
• UC San Diego is recognized as a leading research institution

• **UCSD's JSOE is ranked 5th among public engineering schools, and 9th in the country.**

• **MAE Research Areas:** Controls, Engineering Education, Fluids Mechanics, Materials, Oceanography, Robotics, Biomechanics, Medical Devices, Plasma & Fusion, and Renewables.
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<th>AEROSPACE 1 &amp; 2 YEAR</th>
<th>MECHANICAL 1 &amp; 2 YEAR</th>
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<td><strong>MAE 2- Introduction to Aerospace Engineering</strong></td>
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<td>Physics 2C &amp; 2CL- Physics—Fluids, Waves, Thermodynamics, and Optics</td>
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### Aerospace vs Mechanical

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<td>MAE 175A - Aerospace Engineering Laboratory I</td>
<td>MAE 171A - Mechanical Engineering Laboratory I</td>
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<td>MAE 142 - Dynamics and Control of Aerospace Vehicles</td>
<td>MAE 156A - Fundamental Principles of Mechanical Design I</td>
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<td>MAE 113 - Fundamentals of Propulsion</td>
<td>MAE 156B - Fundamental Principles of Mechanical Design II</td>
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<td>MAE 155A - Aerospace Engineering Design I</td>
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• Take 4 Technical Electives in a subject area and receive a specialization
  • Resume building, Advanced knowledge
• Choose from 70 courses
• Specialize in the following subject areas:
  • Controls & Robotics
  • Fluid Mechanics & Thermal Systems
  • Mechanics of Materials
  • Materials Science & Engineering
  • Renewable Energy & Environmental Flows (REEF)
COOPERATIVE EDUCATION (CO-OP)
The Cooperative Education (Co-op) Internship Program is an immersive work experience in which students are employed full-time by a company for up to six months, which includes summer and one academic quarter, to supplement education with real-world experiences.
For the pilot program (Summer and Fall Quarter), participating departments and class levels include:

- **Undergraduate:** Computer Science & Engineering, Electrical & Computer Engineering, Mechanical & Aerospace Engineering, NanoEngineering, and Structural Engineering.

PARTICIPATING CO-OP COMPANIES
Student Organizations
Boechler group overview (est. 2013)

**Dynamically responsive materials:**
- Role of microstructure → effective properties
- Underlying mechanical phenomena
- Nonlinearity for wave tailoring

**Connect:** Design of mesoscale model systems → experiment-driven exploration of self-assembled nanostructured analogs

**Microstructure + mechanochemistry interaction**
(collab. w/ Boydston, Ganter, Storti, Nelson groups [UW], Craig group [Duke], M. Fermen-Coker [ARL])

**Materials with tailored nonlinear constitutive laws stemming from microstructural geometry**
(collab. w/ Kim group [UCSD])

**Surface instabilities in soft materials**
(collab. w/ Cai group [UCSD])

**Acoustics of biological structured media**
(led by M. Abi Ghanem, collab. w/ T. Dehoux)

**Non-reciprocal materials enabled by photoelasticity**
(collab. w/ Deymier, Lucas groups [UA])
MAE170: Experimental Techniques

Description (typically taken end of 3rd year): Principles and practice of measurement and control and the design and conduct of experiments. Technical report writing. Lectures relate to dimensional analysis, error analysis, signal-to-noise problems, filtering, data acquisition and data reduction, as well as background of experiments and statistical analysis. Experiments relate to the use of electronic devices and sensors.

Physical phenomena

[Diagram of experimental setup with labeled components: Thermistor (temperature sensitive resistance), Signal conditioning electronics, Digitizer, Computer, Voltage source, Thermistor, Internal Oscilloscope Resistance, etc.]

More signal conditioning electronics
Undergraduate research

- Opportunities are widely available, either during the academic year or the summer (start searching winter of 1st year)
- Stipend, academic credit, volunteer, or fellowship
  - NSF REU / REM
- Massively helpful for job search or graduate school applications (experience, recommendations, track record)
- As a student, undergraduate research was one of the most transformative experiences of my life
Multifidelity Modeling
&
Uncertainty Quantification

Boris Kramer
Assistant Professor
Dynamics, Systems and Controls  & Fluids
Prediction
- Long-time prediction provides valuable system insight
- Expensive and time-consuming when physics are complex

Uncertainty Quantification (UQ)
- Uncertain parameters lead to uncertain system responses
- Brings statistics into engineering design

Design
- Exploration of high-dimensional design space
- How can we design under uncertainty?
Model Reduction for Nonlinear Multi-Scale Systems

Reduced-order modeling
- ROM can predict behaviors in complex systems w/o doing the direct simulation of the high-fidelity model.
- Developing advanced computational methods to achieve that

Uncertainty Quantification & Design under Uncertainty

Input Parameters  
\( X_1 \)  
\( X_2 \)  
\( X_3 \)

Model
\( Y_1 = f_1(X) \)  
\( Y_2 = f_2(X) \)  
Cost: \( O(h)-O(\text{days}) \)

Evaluate Quantities of Interest
\( Y_1 \)  
\( Y_2 \)

Quantify Uncertainty
- Failure Probability
- Output distribution
- Sensitivity Analysis
- Rare events

Development of multi-fidelity methods for UQ

Tail-probabilities are very important in design

Histogram of project cost given uncertain inputs

PDE
\[ \frac{\partial s}{\partial t} = f(s) + Bu \]

FEM/FVM/FD

N-dim. ODE
\[ \dot{s} = f(s, t) + Bu \]

Model Reduction

n-dim. ODE (n<<N)
\[ \hat{\dot{s}} = \hat{f}(\hat{s}, t) + \hat{Bu} \]
Hello, I am Daniel Ho

About me:
About Me:
• 5th Year (3rd Year Transfer)
• Earl Warren College
• Transferred from a Community College in Sacramento, CA

Experience:
• College Ambassador
• RA - Village
• Intern
  • DAV Energy
  • Industrial Environmental Association
• I switched from Environmental Engineering to Mechanical Engineering last Winter but have always been passionate about environmental issues. I work with them to this day.
Hello, I am Jonathan Rodriguez

About me:
• Aerospace Engineering 3rd Year Transfer
• Muir College

Experience:
• 2018 – UTC Aerospace Systems, R&D Mechanical Eng. Intern
  Studied compressible flow in aircraft ducts

• 2019 – Collins Aerospace, R&D Mechanical Eng. Intern
  Researched current tooling issues, investigated potential solutions

• During my last year at UCSD I have been able to take many classes regarding composite aerostructures. Upon graduation, I hope to be able to progress in the field of composites for years to come.
Hello, I am Claire Stones

About me:
• Major: Mechanical Engineering
• Specialization in Renewable Energy and Environmental Flows
• Minor: Climate Change Studies
• Fourth year, graduating in Winter 2021
• Eleanor Roosevelt College

Experience:
• Member of Engineers for a Sustainable World (ESW) for 3 years
• Project Lead of CommUnity Garden, an ESW project that works to increase food security for low-income high school students and to inspire them to pursue STEM in college, for 1.5 years

• I switched my major twice, from Biology to Environmental Engineering to Mechanical Engineering.
• I am passionate about sustainability and combating climate change. My career interests are renewable energy and sustainable building design.
Faculty
- How can undergraduates benefit from the top-notch research at UCSD?
- What drew you to UCSD?

Students
- What extracurricular activities have you or your classmates been engaged in (internships, student orgs, etc..)?
- How has MAE prepared you for your future career?
- What advice would you like to give prospective students still deciding on a school?
VISIT OUR TRITON DAY Q&A DOCUMENT FOR A LIST OF QUESTIONS & ANSWERS FROM THE EVENT!