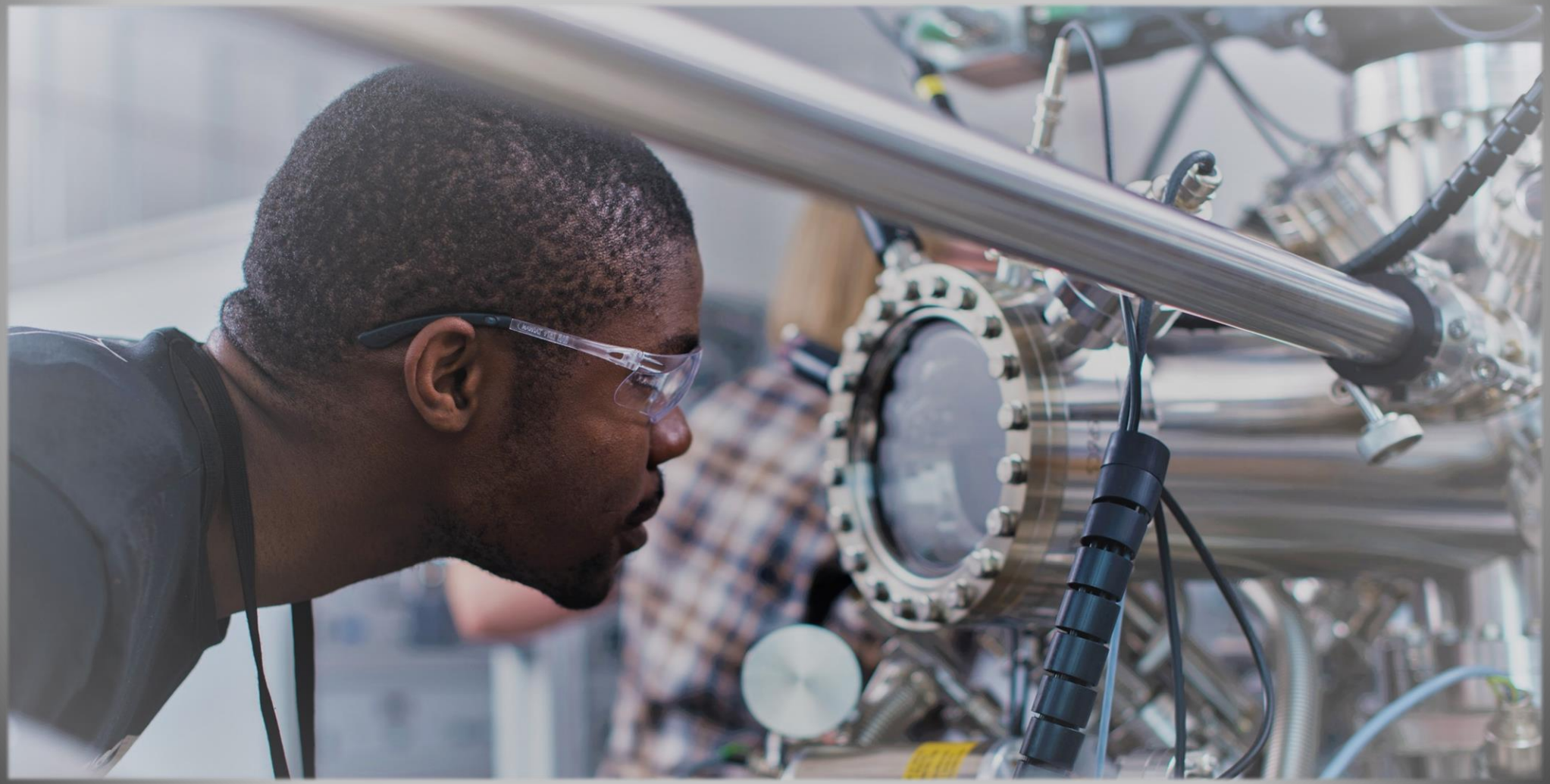
Oregon State University

COLLEGE OF ENGINEERING

College of Engineering & Honors College Thesis Showcase



COE/Honors College Research Showcase 2021

Oregon State University
College of Engineering

Teaching

- *Process Engineering Senior Lab*
- *Polymer Science &Engineering*
- *Transport Phenomena (3rd Yr CBEE)*
- *UHC Colloquia –*
  - *Plastics for Poets (Sp)*
  - *Energy IQ (W)*
  - *STEM Outreach (Sp)*

Skip Rochefort

School of Chemical, Biological, and Environmental Engineering

Gleeson 205

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Research

Anything related to POLYMERS!

Plastics Processing and Recycling

Biomaterials

Environmental Sustainability

Engineering Education

K-12 Outreach

Thesis Topic Ideas/Opportunities

- *Waste Plastics to Fuel (Pyrolysis/Gasification)*
- *Encapsulation of bacteria for bioremediation*
- *Fire Resistant Roof Design for Wildfire areas*
- *Menstrual Health and Hygiene - Compostable Feminine Hygiene Pads for Developing nations*

How To Implement SAP? Wildfire Resistant Roof!

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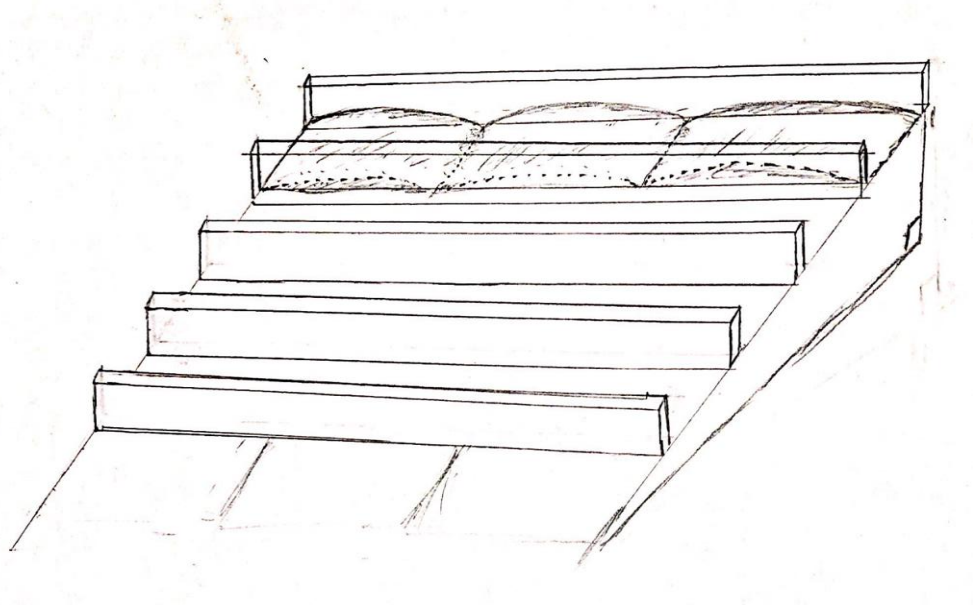
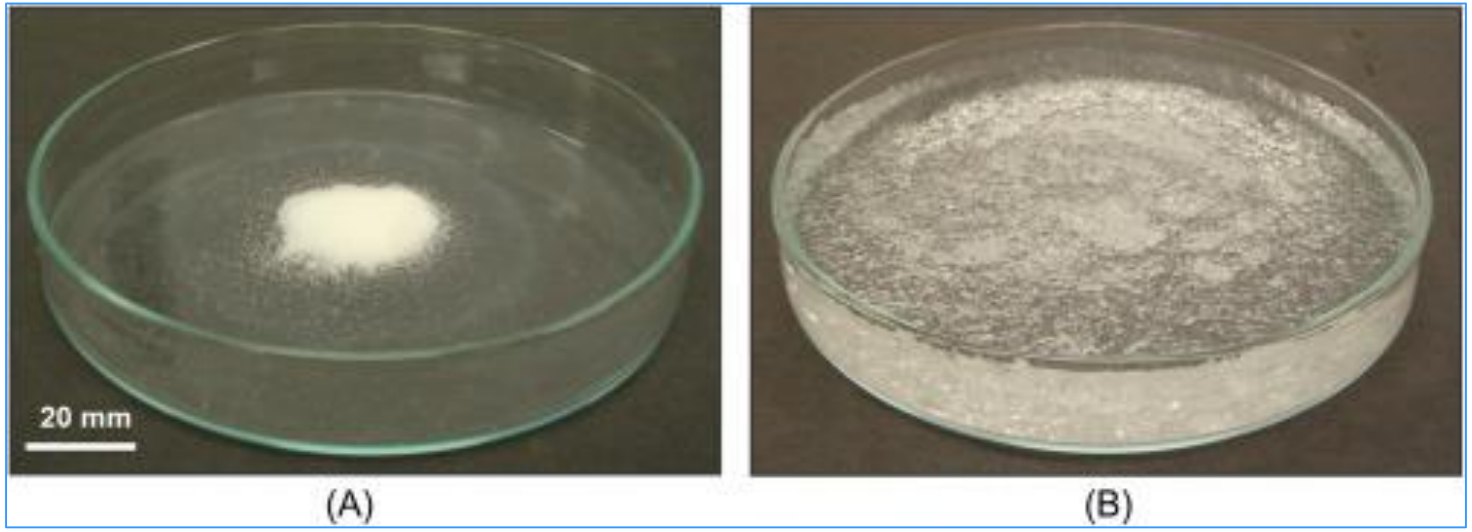
College of Engineering



SAP “pillows” in roofing system

What makes it so GREAT?
SuperAbsorbant Polymer (SAP)

Oregon State University
College of Engineering



Dry Powder

Hydrated Gel

Roof Assembly
SAP PILLOWS (Hydrated)

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College of Engineering

Charlie (UG ChE) and Emma (UG ME)

SAP Pillows Hydrated

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Test Setup: Photos

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Mid-burn Example

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End Results

Back of Control Roof:

Front of SAP roof:

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College of Engineering

ENGR 415/416
Multidisciplinary Engineering
Capstone Design

- *Global Formula Racing*
- *Beaver Racing Baja*

Joe Piacenza
Bob Paasch

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paasch@oregonstate.edu

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GFR and SAE Baja

- *Testing and Data Collection*

Formula Student Spain 2021

- *Autonomous Driving*

Click image above for link

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Teaching

CHE311, Thermodynamics (180+ students)

CHE444/544: Thin Film Materials Processing (40 students)

CHE452/552: Electrochemical Energy System (~20 students)

Zhenxing Feng

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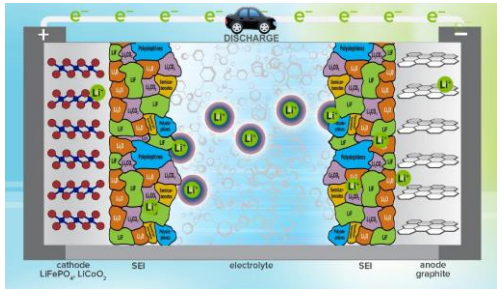
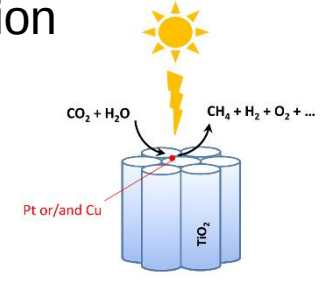
Research

Energy storage: lithium/sodium batteries

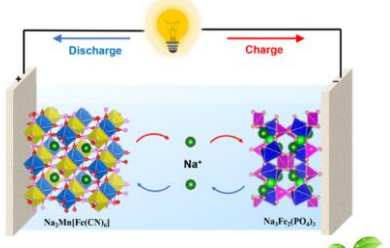


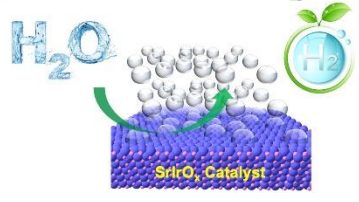
Energy coversion: fuel cell, water splitting, CO_2 reduction



Thesis Topic Ideas/Opportunities

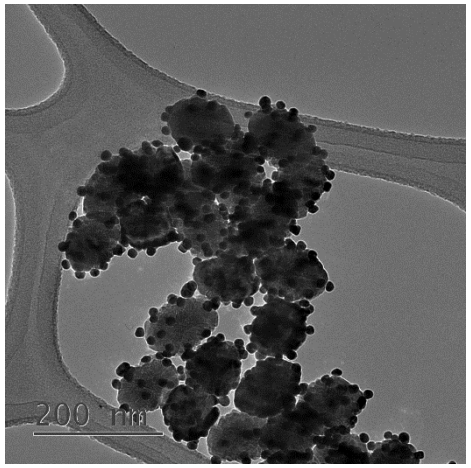
1. Aqueous sodium-ion batteries
2. Cost-effective electrocatalysts for green hydrogen generation.



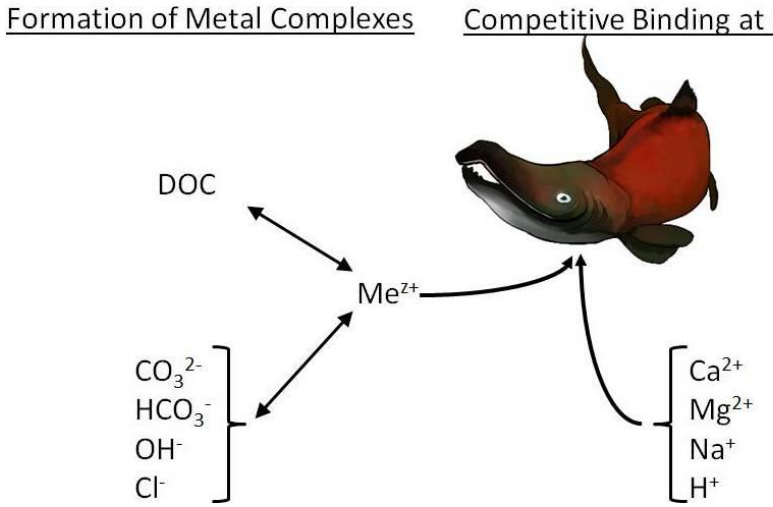


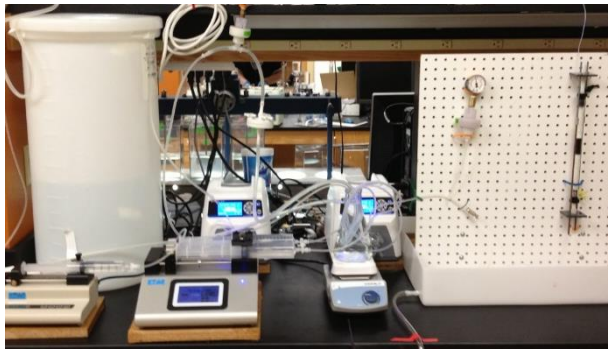
Research Areas

- Physical and Chemical Processes for Water Quality Control
- Aquatic Chemistry
- Fate and Transport of Particulate Contaminants



BLM Conceptual Framework





Jeff Nason

Professor & Associate Head for Graduate Programs
School of Chemical, Biological and Environmental Engineering
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JOHN 316E

Oregon State University

Previous Honors College Theses

- Quantification of **C_{60} Particle Characteristics** in Environmentally Relevant Aqueous Systems
- Characterization of Biochar for Use in **Treating Copper (II) Polluted Stormwater**
- The Effects of UV Irradiation on the **Biosorption of Titanium Dioxide Nanoparticles** to Heterotrophic Biomass
- Comparison of Aqueous **Cu^{+2}, Pb^{+2}, and Zn^{+2} Adsorption** with Pyrolyzed Hazelnut Shells and a Commercially Produced High-Carbon Fly Ash
- Comparison of Experimentally-determined and Model-estimated Attachment Efficiency for **Predicting Nanoparticle Aggregation**

Potential Projects

- **Heteroaggregation of engineered nanoparticles/plastics** with naturally occurring particles
- **Eco-corona formation on engineered nanoparticles/plastics**
- Passive **treatment of iron and ammonia** in landfill leachate
- Evaluating the impacts of natural organic matter on the **removal of metals from stormwater and wastewater**

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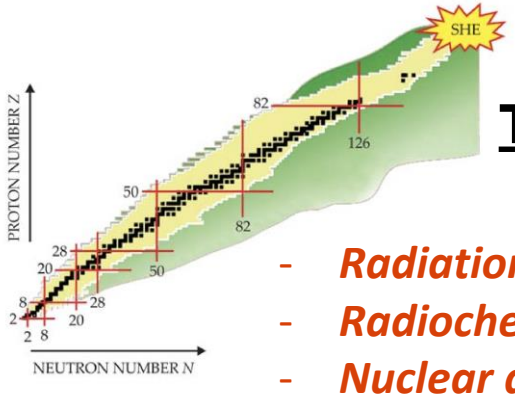

Teaching

- *Radiation Detection and Measurement*
- *Radiochemistry (soon)*
- *Nuclear and Radiation Physics (soon)*
- *"An Introduction to Alchemy" (soon?)*

Sasha Chemey – New PI!

Nuclear Science and Engineering

"The Alchemey Lab"

A106 Radiation Center

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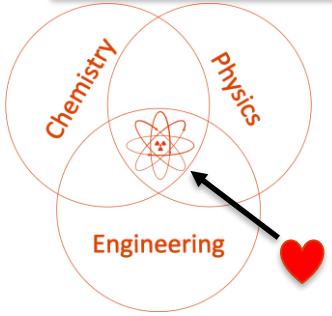
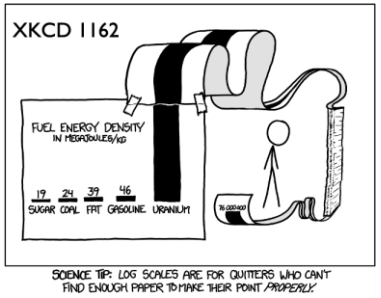
@alchemeynerd





Research

The **Alchemey Lab** works at the interface of nuclear chemistry, physics, and engineering to address interdisciplinary questions.

We synthesize new elements and compounds to solve generational challenges in pollution, **green** energy, and fundamental questions about nature.

There are projects in physics, nuclear and radiochemistry, and materials engineering – plenty of work for everyone, and lots of exciting research to be done! Email me and let's chat!

Thesis Topic Ideas/Opportunities

CURRENT ONGOING UNDERGRAD PROJECTS

- Calculate predicted products for reactions to make advanced nuclear fuels more affordably/sustainably
- Synthesize advanced nuclear fuels nuclear waste disposal forms
- Model nuclear reactions with gold to study nuclear structure
- OPENING: Structure and spectroscopy of complexed lanthanides
- OPENING: Modeling a supernova/neutron star for astrophysics!
- ??? ⟵ Tell me what you are interested in, we can figure out a creative project together!

University of Warwick/Mark Garlick →

Kyle Niemeyer & Niemeyer Research Group

Teaching

- ME 373: Mechanical Eng. Methods
- ME 461/561: Gas Dynamics
- ME 499: Propulsion

python™

GitHub

Kyle Niemeyer

Associate Professor

Mechanical, Industrial, & Manufacturing Eng.

Rogers 320

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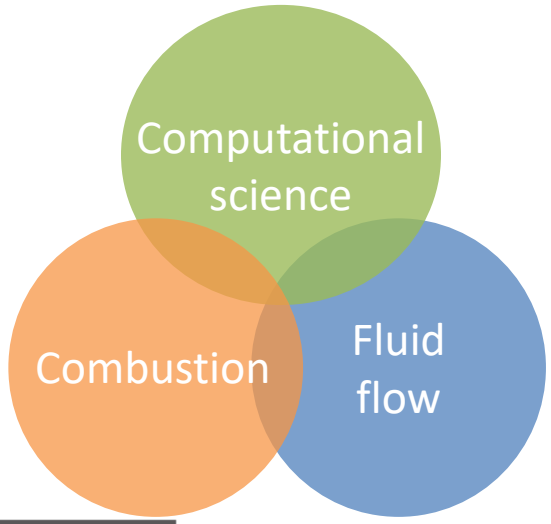
niemeyer-research-group.github.io

NRG

Research



OPEN SCIENCE

Project Ideas

- Simulate combustion, flames, and fires
- Simulate fluid mixing in the ocean
- Simulate neutron transport in nuclear reactors
- Simulate nuclear blasts and shock waves

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College of Engineering

Teaching

- ***Neutronics Analysis II***
- ***Society Aspects of Nuclear Technology***
- ***Nuclear Materials Characterization & Qualification***
- ***Introductory Fluid Mechanics***

Tianyi Chen

Assistant Professor

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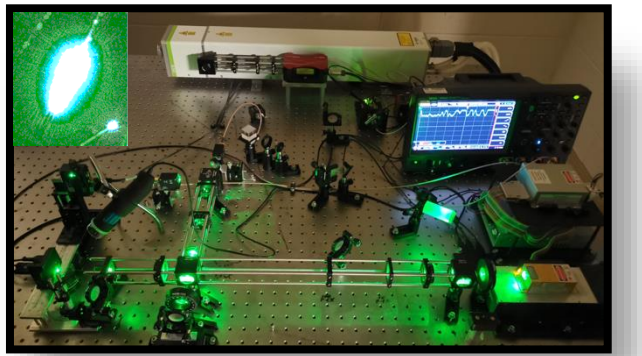
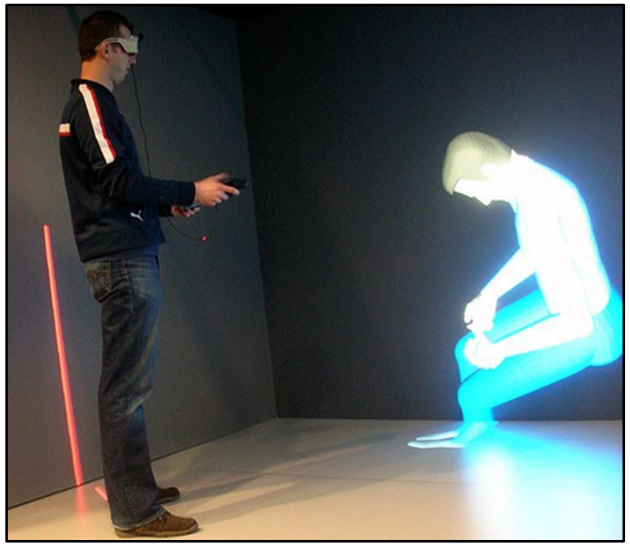
Research

- Laser-based materials processing and high-throughput characterization.



Thesis Topic Ideas/Opportunities

- ***Data-driven materials science: high-throughput local property characterization.***
- ***To make materials both strong and ductile: three-dimensional microstructural manipulation.***



Design Engineering Lab

Onan Demirel
Assistant Professor
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Oregon State University

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Website-2: http://design.engr.oregonstate.edu/demirel
322 Rogers Hall | (765) 409-9419 | Corvallis, OR 97331

Research Interest:

Design Theory and Methods

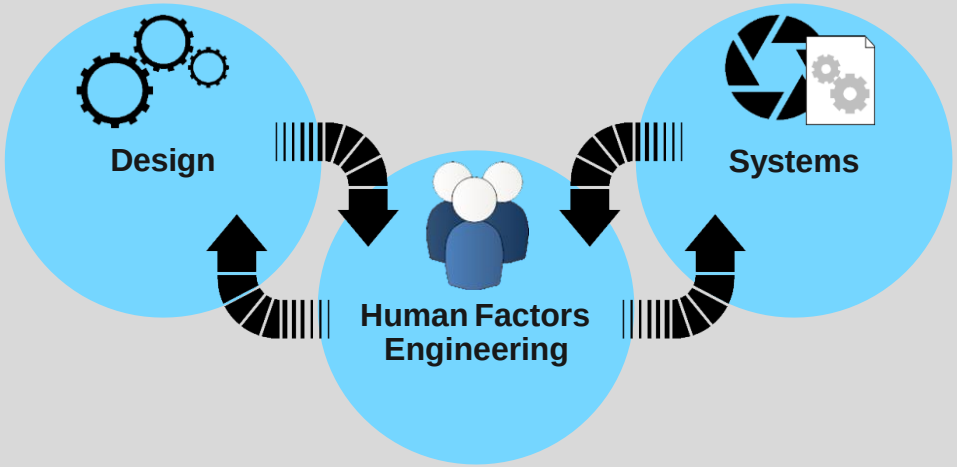
Human Factors Engineering

Digital Human Modeling

Product Design and Development

Human-Centered Design

Computational Design



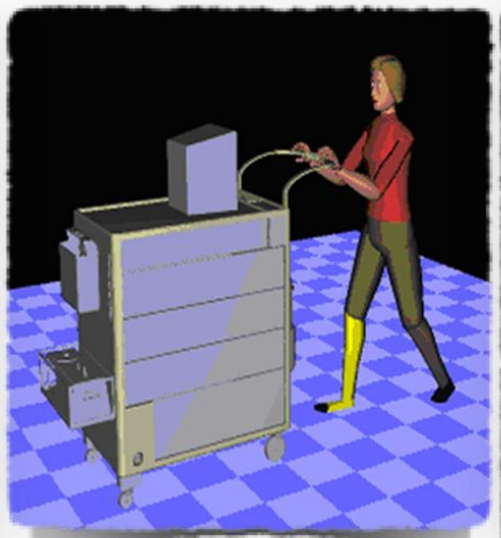
Designing with Digital Humans

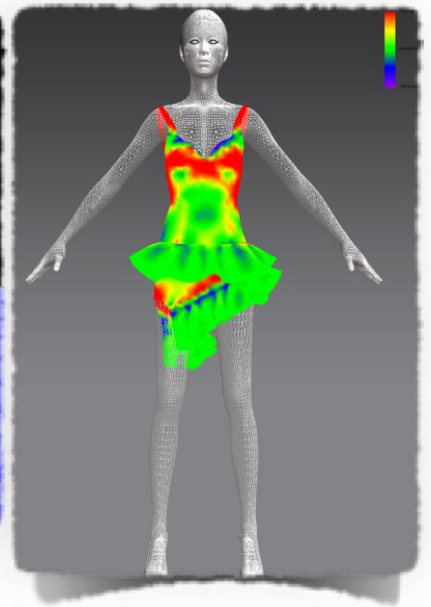
Human-in-the-loop Research:

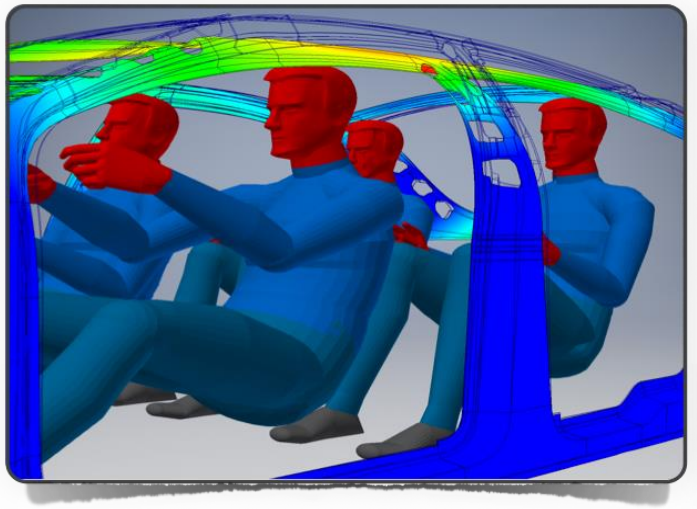
- Human-centered design
- Safety and risk assessment
- Fit and comfort evaluation
- Usability studies
- ….

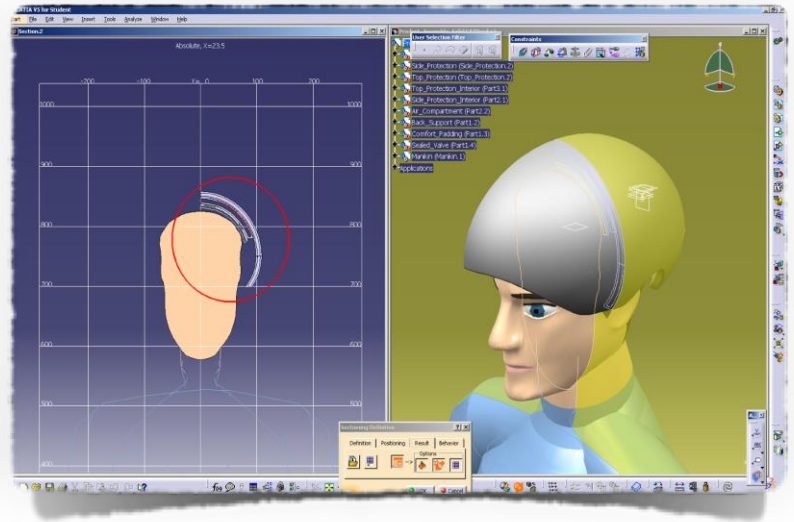
Modern Product Development:

- Transportation design
- Advance manufacturing
- Medical products
- Consumer goods
- Exoskeletons and prosthetics
- …









College of Engineering and HC Thesis Mixer

Teaching

- ME373/ME373H–Mechanical Engineering Methods
- ME331– Fluid Mechanics
- ME526 – Numerical Methods for Engineers

Sourabh V. Apte

School of MIME, Rogers 308

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http://web.engr.oregonstate.edu/~sva/

Research

- My group works on development and application of numerical algorithms for predictive simulations of fluid flows, often turbulent and particle-laden two-phase flows.
- Applications: Any problem that involves a turbulent flow with and without heat/mass transfer
- UHC students usually do some code development work in Matlab/Python and work with graduate students to conduct parallel computing on supercomputers using our in-house solvers.

Thesis Topic Ideas/Opportunities

- Modeling motion of spherical and non-spherical particles in turbulent flow with and without heat transfer (erosion of ducts, gas-turbine blades, solar receivers, sprays etc.)
- Effect of ventilation system on dispersion of pollutants (aerosols and droplets carrying bacteria or virus---Covid19)
- Cluster formation and data analysis using Voronoi tessellation
- Turbulent flow over rough surfaces (drag reduction, sediment transport)

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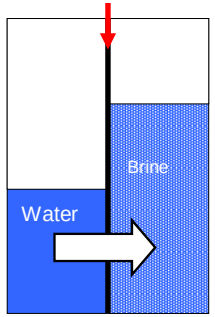
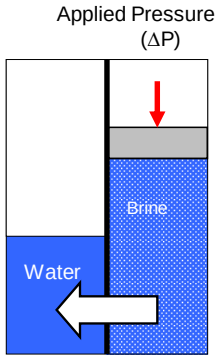
Membrane Nanotechnology for Sustainable Water Supply

Semi-permeable membrane:



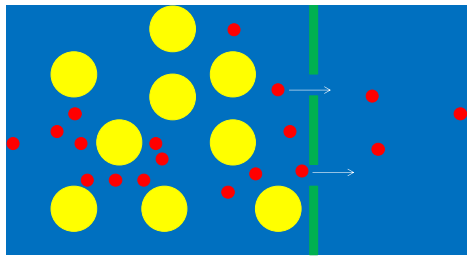
Forward Osmosis

https://rogerdhansen.files.wordpress.com/2011/09/forwardosmosis2.jpg



Reverse osmosis

$\Delta P > \Delta \pi$



Colloidal and interfacial phenomena

Material characterization

Membrane material and processes

- Membrane fouling
- Removal emerging contaminants
- Develop hybrid membrane systems
- Develop novel composite membranes

Practical applications

- Surface water filtration
- Wastewater treatment and reuse
- RO desalination
- Oil-water separation
- Alternative energy solutions

Nanotechnology-enhanced membrane filtration

Nanotechnology-enabled water treatment

Environmental application and implication of nanotechnology

- Anti-bacterial activity
- Toxic effects in biofilm development

Practical applications

- Water disinfection
- Membrane surface self-cleaning and biofilm control

Sustainable water supply

Dr Xue Jin

Assistant Professor, Environmental Engineering

School of Chemical, Biological & Environmental Engineering

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541-737-7968, 216J Johnson Hall

Thesis Topic Ideas/Opportunities

1. Optimizing membrane drinking water treatment process
2. Aerobic granular membrane bioreactor for wastewater treatment/reclamation
3. Nutrients and clean water recovery from waste for sustainable food production

Pam Van Londen Sr Instructor

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Inclusive Teaching and Learning

This year, my focus is inclusive teaching/learning. Incorporating a Cognitive Styles assessment into computing courses helps students understand their learning style, which can help them avoid imposter syndrome. Marginalized groups often feel they do not have the mindset or prerequisite skills to collaborate with their peers, when in fact, they do! Learn more about other Leaky Pipeline concepts and statistics in STEM.

CS 391 Ethics students will collaborate on a Promise of Technology project to develop a proposal to combat poverty. See the previous project proposal hosted on the project blog to get a sense of the scope of work.

The Leaky Pipeline

Reasons why women and marginalized groups leave STEM jobs at high rates.

"In 2019, 2.8% of funding went to women-led startups; in 2020, that fell to 2.3%." (HBR 2021)

"Pay disparity for women increased by 3% between 2010 and 2015, and has remained stable at 23% in recent Years." (UCSD)

Lack of investment: women-owned businesses receive less venture funding. Investment in mentors is low.

Gender bias in hiring, pay, research, and artificial intelligence input/output.

Glass ceiling: lack of advancement in professions and corporate ladders; being placed in jobs that do not progress to more responsibility and higher salaries.

Glass Cliff: Hiring high-profile women during a crisis, when the outcome isn't going to be successful no matter what they try (scapegoating).

"Married or partnered heterosexual couples in the U.S. continue to divide household chores along largely traditional lines..." (Gallup 2020)

Second Shift:

- Research shows women typically do most of the housework and child rearing duties which occur after already working a full day.
- Long hours and travel schedules conflict with women's heavy household management workload.
- Lack of fair work-scheduling and family leave laws.

"Up to 60% of disconnected students cannot pay for internet access or devices.

About 25% of students live in areas that lack high-speed internet.

About 40% of students face language barriers and other issues." (Tate 2021)

Digital Divide, such as an early lack of opportunity to experience STEM and lack of access to technology at home and school.

Inhospitable work cultures:

- **Brogramming:** Programming without any regard for others around you; lack of manners.
- **Manterrupting/mansplaining:** When a man interrupts a woman to educate her on a topic because he believes she isn't capable of understanding it.
- **GamerGate:** Misogynistic maelstrom of death threats from men who fear women.
- **Double jeopardy:** Women of color having to work twice as hard because they are women and not white.
- **Prove-it-again:** Women having to work twice as hard to continue proving they know what men know.
- **Isolation** from other women or similar cultures.

Imposter Syndrome: General feeling of inadequacy even though they have the necessary skills.

Firefighting, such as always working under an unreasonable deadline for the high workload. Conflict between preferred work rhythms and the firefighting work style, which is generally rewarded.

In 2018, 16% of private-industry workers had access to paid family leave. (BLA 2019)

"While on leave, substantially fewer women than men receive full pay (32 percent versus 55 percent)" (DOL 2021)

Patriarchal classrooms and teacher bias (especially towards African American girls and boys).

"Black girls are more than 4x more likely than White girls to be arrested at school." (EdTrust 2021)

Lack of encouragement from parents from birth onward.

Forcing gendered roles with language (he/she), color, toys, tools, clothes, and lack of role models.

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College of Engineering and HC Thesis Mixer

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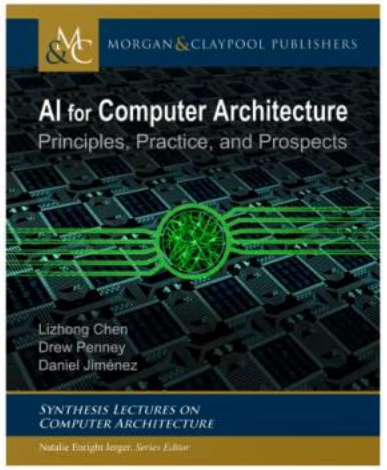
Teaching



- Computer Architecture
- GPU Architecture
- Machine Learning Accelerator
- High-Performance Computing

Lizhong Chen

School of Electrical Engineering and Computer Science

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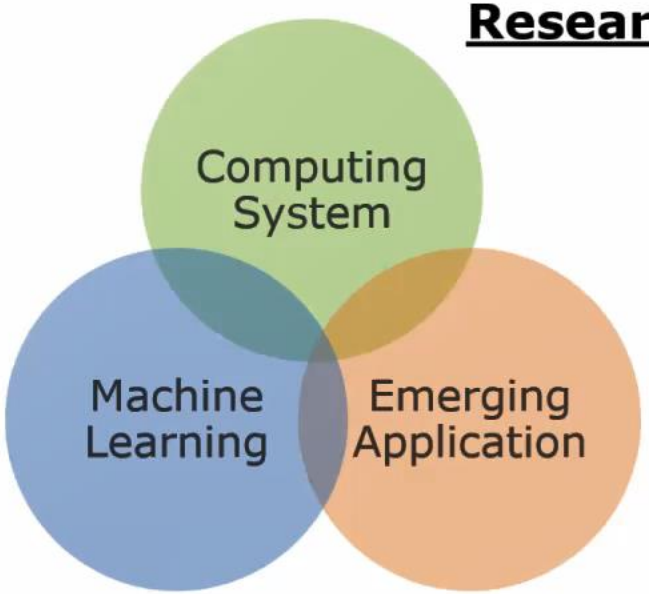
Research



Supported by:

NSF · U.S. DEPARTMENT OF ENERGY · intel · NVIDIA · NIH · Google · XILINX

Thesis Topic Ideas/Opportunities

- Machine learning accelerators
- Applications of AI in computing systems
- Intelligent mobile and wearable devices
- General-purpose CPU and GPU designs
- Data centers and supercomputer Optimization

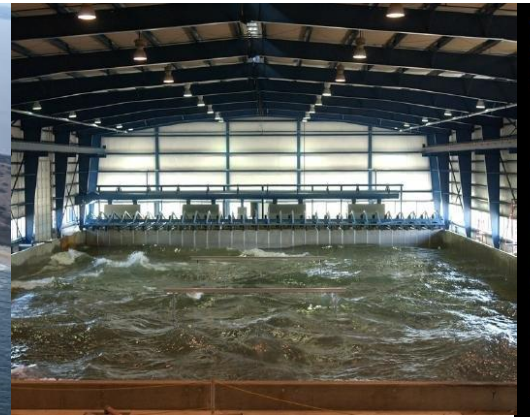
Meagan Wengrove

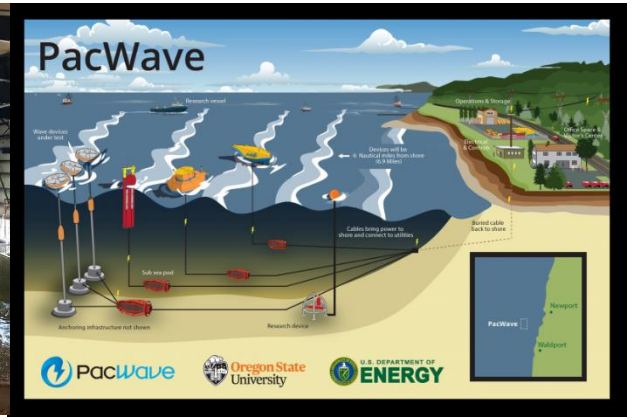
Assistant Professor: Coastal & Ocean Engineering, Oregon State University

Specialty: Sediment Transport, Signal Processing, Nearshore Hydrodynamics

Ocean Bottom Fiber Optic Sensing – We are using subsea fiber optic cables (think the cables that provide internet across the ocean and connect instrument platforms to shore) to measure ocean waves and currents.

Typically ocean bottom sensors are only in discrete locations, but we will be able to sense over 50 km of distance with sample spacing of 10 m. That's 5000 samples!!!! We could change the standard of ocean sensing.





You can come to the field with us!

We will have projects on the beach in Hawaii, North Carolina, and Oregon

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