Research – global impact

- Hydrological processes - John Day River
- African Hydrology - install 20,000 weather stations
- Chilean Hydrology
  Runoff processes
- Instrument development
  10,000x better resolution
- Laboratory Visualization
  Nano particles and non-Newtonian fluids

Topic Ideas/Opportunities

- Make new sensing systems for environmental monitoring
- Improve African meteorological data by cross-comparison between stations
- Fiber Optic Sensors to improve understanding of environmental processes
- Unmanned vehicles for environmental sensing

Open-Sensing.org
The OPEnS team

95% undergraduate employees (30+1MS)

Paired staffing - teams
Busy Place! Typically 10 folks in lab
A Taste of OPENs projects

Cosmic Rays for Environmental Se...
Dendrometer
eDNA Sampler
eGreenhouse
Evaporometer
HyperRail
LoRa Hub
OPENSampler
Project Loom
Rain Gauge Calibrator
RFID Moisture
Sap Flow Meter

Smart Rock

Slide Sentinel
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)

Research
Anything related to POLYMERS!
> 45 yrs research/ 30 yrs OSU
Plastics Processing and Recycling
Biomaterials
Environmental Sustainability
K-12 Outreach

Skip Rochefort
School of Chemical, Biological, and
Environmental Engineering
Gleeson 205
541-231-6768 (text only)
skip.rochefort@oregonstate.edu
AIChE Fellow
CBEE Student Chapter Advisor (30 years)

Thesis Topic Ideas/Opportunities
Note: Typically 15-20 UG Researchers
- Waste Plastics to Fuel (Pyrolysis/Gasification)
- Encapsulation of bacteria for bioremediation
- Plastic/Hemp Composite Filament 3D Printing
- Wildfire Resistent Roof and Personal Shelter
Rochefort Polymer Lab Research Projects – March 2022

• **Waste Plastics to Diesel Fuel (PTF)**

• **NIEHS- R01 $1.5 million/4yrs Hydrogel Bead Encapsulation of Microbes to Treat Contaminant Mixtures in groundwater**

• **Development of a Wildfire Resistant Roof and Personal Shelter**

• **SERDP $1.52 million/4yrs Quantification and Identification of PFAS and Total Fluorine during Thermal Degradation of Fluoropolymers in the Presence of Explosives**

• **Menstrual Health and Hygiene: Hemp-based Compostable Pad**

• **3D printing of PLA/Hemp filament of varying Hemp Content**

• **Recycled Ocean and Ag Plastics in HP Printer Cartridges**

• **Spin Coating of water-based waxes on silicon substrate**
Rochefort Polymer Lab

Friday Afternoon FroYo FUN

Polymer Group Weekly Zoom Meeting

October 31, 2022
Nick AuYeung, School of Chemical, Biological, and Environmental Engineering

Sustainability, Decarbonization, Energy Efficiency

• Storage of heat using reversible chemical reactions
• Solar-driven fuel/chemical production
Current Work and Potential Topics

• Thermal/thermochemical storage
  – High temp HX-reactors
  – Waste heat recovery
  – Thermochemical cookstoves
  – Low temp thermal storage

• Solar displacement of fossil fuels
  – Renewable process heating for industry
  – Alternative fuels (e.g. H₂)

• Open to your interests!
• nick.auyeung@oregonstate.edu
Scalable Nanomanufacturing of Functional Nanomaterials

Potential Projects

Metal-Organic Frameworks (MOFs)

- MOFs are a class of nanoporous materials that consist of metal cations coordinating to organic linkers to form 0-, 1-, 2-, or 3-dimensional structures.

<table>
<thead>
<tr>
<th>MOFs</th>
<th>Zeolites</th>
<th>Activated Carbons</th>
<th>MOFs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Surface Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>~500 m²/g</td>
<td>~1500 m²/g</td>
<td>Up to 7500 m²/g</td>
</tr>
<tr>
<td>Structure</td>
<td>Crystalline</td>
<td>Amorphous</td>
<td>Crystalline</td>
</tr>
<tr>
<td>Pore Size Distribution</td>
<td>Narrow</td>
<td>Broad</td>
<td>Narrow</td>
</tr>
<tr>
<td>Pore Size</td>
<td>0.3-1 nm</td>
<td>0.3-5 nm</td>
<td>0.3-10 nm</td>
</tr>
<tr>
<td>Molecular Tunability</td>
<td>Low</td>
<td>Very Low</td>
<td>Large</td>
</tr>
</tbody>
</table>

Curating MOFs for Gas Sensors

With Dr. Haori Yang (NSE) and Cory Simon (CBEE)
Biomedical Device Research
Therapeutic Medical Devices: Extracorporeal Blood Processing using Microscale-based 2-D Lamina Plate Technology

Intensified Separations Research
Modular, Microscale-based Liquid-Liquid Extraction for Biofuels production and Lithium and Rare Earths Extraction

Water Treatment Research
Point-of-Use, Microscale-based UV-C Photoreactor for Inactivation of Waterborne Pathogens

Thesis Topic Ideas/Opportunities
- Investigating blood damage within microchannel devices
- Modeling and digital Simulation – device level, process level
- Wearable Biomedical Devices in Therapeutic Blood Processing
- New applications in Rare-Earth Elements Extraction (Li, Nd, Eu, Ce)
- UV-C inactivation of pathogens in drinking water
- 3D printing of microchannel devices (ATAMI)

Teaching
Prof. Jovanovic:
- Undergraduate & Graduate Fluid Flow
- Microreactors & Microscale Chemical Technologies

Prof. Jovanovic & Dr. Coblyn:
- Modular Chemical Process Intensification (MCPI)
**RESEARCH ON SECURE-AI SYSTEMS LAB (SAIL)**

**AI IS AMAZING, BUT IT FAILS...**

- Autonomous Cars
- Robot Surgery
- Uber’s AI Car Fails
- Adversarial Input

**PEOPLE WORK ON MAKING IT SECURE**

- Secure Learning
- Secure HW, Systems

**RESEARCH: BUILDING SECURE AI FROM A HOLISTIC VIEW**

**THESIS TOPICS AND OPPORTUNITIES**

- Breaking deep learning models
- Breaking existing defenses against attacks
- Understanding why attacks are possible
- Develop a better defense mechanism

... or you can propose your own idea(s)

**CONTACT ME:**

Sanghyun Hong
Assistant Professor
School of Computer Science
sanghyun-hong.com
sanghyun.hong@oregonstate.edu

**Unique Perspective:** AI is not a mathematical concept, but also a computational tool running on h/w and s/w

**My work focuses on:**
- New security/privacy attacks on ML
- Understand ML’s internals
- Develop defense mechanisms

**WOULD IT LEAD TO SECURE AI WORLD? No**

**SECURE LEARNING**

**SECURE HW, SYSTEMS**

**HW (CPU OR GPUs)**

**SOFTWARE**

**AI MODEL**

**HUMANS**
Teaching

- Human-computer Interaction
- Web development
- Collaborative software engineering
- Engineering ethics

Research

- Computing & Engineering Education
- Learning and data analytics
- Collaborative software engineering
- Social learning environments
- Human-computer interaction

Thesis Topic Ideas

- Exploring GitHub analytics for software development teams
- Developing metrics to assess software team processes and progress
- Learning analytics and visualization environments for computer science and engineering education
- Studying software team communication through Slack/MS Teams chat logs and Zoom recordings

Chris Hundhausen
Professor
Associate Head of Online Programs
School of EECS
Kelley 2113
chris.hundhausen@oregonstate.edu
Research problem:
1. How can we improve the pedagogy and reduce skills gap?
2. How can we leverage software development processes & products?

Collaborative Software Development Skills
- Mining repositories
  - Commits
  - Issues
  - Pull-Requests
  - Project Board
- Measuring contributions
- Impact on process & product quality
- Impact on peer evaluation

Developer Communication
- Investigating chat data
  - Slack/Teams
  - Repository comments
- Content analysis
  - Planning, contribution, help-seeking, reflection, socialization & emotional responses
- Temporal patterns of communication
- Impact on peer evaluation
Generative Particle-based Variational Inference

- For many applications, high predicted accuracy is insufficient, we want to know when our models are uncertain
- One hypothesis suggests: given many models, each model responds to outlier data differently, and by averaging their predictions, we can identify anomalies.
- This can be achieved by Ensemble of models. However, training large number of models is computationally inefficient.
- We are investigating this problem using Generative Particle-based Variational Inference, that is capable to output samples weights for the target neural network.
Learning for Open-world Novelty Detection

- AI systems are not very good at adapting to constantly changing conditions.
- AI systems are mostly overfit to the closed set of data.
- We are investigating different ways to create AI systems that act appropriately and effectively in novel situations that occur in open worlds.

Uncertainty in Under Water Object Segmentation

- The performance of neural networks on objects that can appear in real-world settings is not reliable.
- We are investigating computer vision algorithms to detect uncertainty in underwater objects segmentation.
- Knowing uncertainty around the boundary pixels of objects can help us in better object grasping for robotics manipulation tasks.

ENGR 415/416-001
Multidisciplinary Capstone Design

- Global Formula Racing
  - https://www.global-formula-racing.com
- Beaver Racing Baja
  - https://beaverracing.org
Richard E. Wirz  
Executive Director of Aerospace Research Programs,  
Boeing Professor, MIME;  
Dearborn 221, 541-737-8280  
Richard.Wirz@oregonstate.edu

Research
Experimental and computational investigations in areas related to:
- Advanced space propulsion
- Air-breathing electric propulsion
- Fusion energy
- Plasma-material interactions
- Plasma-medicine
- Plasma devices and cathodes

Teaching
- Space Engineering and Technologies
- Aerospace Plasmas

Thesis Topic Ideas
- Optimal design of vacuum facilities and thruster and cathode operation for NASA high-power electric propulsion
- Plasma-material interactions for complex surfaces for application to clean fusion energy
- Experimental design for improving plasma-medicine sources
- A new cathode design for research and education in low-temperature plasma physics
Teaching

- ME373/ME373H (Honors section of Mechanical Engineering Methods)
- ME331 (Fluid Mechanics)
- ME526 (Numerical Methods for Engineers)

Research

- My group works on development and application of numerical algorithms for predictive simulations of two-phase turbulent flows.
- UHC theses involve developing models (in Matlab/Python), and/or using in-house research solvers to study turbulent flows using supercomputers.

Thesis Topic Ideas/Opportunities

- Modeling motion of non-spherical particles in a turbulent flow (sprays and spray ligament breakup in combustion chambers, burning wood particles in fires etc.)
- Modeling turbulent flow over rough surfaces (drag reduction, turbulence in porous media, sediment transport)
- Effect of ventilation system on pollutant dispersion

Sourabh V. Apte
School of MIME, Rogers 308
sourabh.apte@oregonstate.edu
Past UHC Theses:
http://web.engr.oregonstate.edu/~sva/theses.html
College of Engineering and HC Thesis Mixer

Materials for Extreme Environments & Nuclear Applications (MEENA)

Tianyi Chen
Assistant Professor

School of Nuclear Science and Engineering; Radiation Center E124
541-737-8190
Tianyi.chen@oregonstate.edu
Opportunities

- Undergraduate research assistant positions.
- Welcome both hands-on and computer students.
- Publications and conferences.
- Scholarships and internships.
Computational radiation transport is widely applicable in science and engineering.

- Nuclear reactor design/analysis
- National security
- Radiation detection
- Medical physics
- Astrophysics
- Material science (phonons!)

https://physicaps.org/assets/10.1103/Physics.10.41/figure/1/thumb

https://upload.wikimedia.org/wikipedia/commons/thumb/e/ed/Preamplifier_at_the_National_Ignition_Facility.jpg/400px-Preamplifier_at_the_National_Ignition_Facility.jpg

https://physics.aps.org/assets/10.1103/Physics.10.41/figure/1/thumb

https://www.energy.gov/sites/default/files/styles/full_article_width/public/090712.jpeg?itok=RTgGXCvC

https://upload.wikimedia.org/wikipedia/commons/thumb/e/ed/Preamplifier_at_the_National_Ignition_Facility.jpg/400px-Preamplifier_at_the_National_Ignition_Facility.jpg

ExaSMR, ORNL

Christian Ott, Cal. Tech.
Ongoing projects

- Center for Exascale Monte Carlo Neutron Transport
- Thermal radiation diffusion for nuclear weapons effects simulation
- Autonomous control of nuclear microreactor (USNC-Tech)
- Optimization of used fuel from multiple small modular reactors in a shared fuel pool
- Multiphysics simulation of Annular Core Research Reactor fuel material state
- Uncertainty quantification in Monte Carlo radiation transport simulations
- Computational neutron radiography of concrete

Want to use high performance computing and applied math to solve challenging physics/engineering problems? Like to write/run code?

Todd.Palmer@oregonstate.edu
Naomi T. Fitter, Ph.D.
Assistant Professor of Robotics
Oregon State University

Socially Assistive Robotics

Haptics
Entertaining Interactions
Robotics
Oregon State University

Ravi Balasubramanian
Collaborative Robotics and Intelligent systems (CoRIS) Institute

http://robotics.oregonstate.edu/
OSU Robotics Faculty

- Robotic grasping and manipulation
- Legged robotics
- Marine robotics
- Energy generation and control
- Agricultural robotics
- Undulating robotic
- Manufacturing robotic
- Social robotics
- Drones
- Human-robot interaction
- Swarms
Robotics and Human Control Systems
Ravi Balasubramanian

• Research Interests:
  - Robotic Control and Dynamics
  - Human neuro-biomechanics

• Applications:
  - Mobile Robotics
  - Robotic Hands
  - Robotic Manipulation
  - Orthopedic implantable mechanisms
Teaching

- ENVE 322: Fundamental of Environmental Engineering
- ENVE 421/521: Drinking Water Treatment
- ENVE 535: Physical and Chemical Treatment

Research: Membrane Nanotechnology for Sustainable Water Supply

- Membrane material and processes
  - Membrane fouling
  - Membrane cleaning
  - Nanotechnology for membrane systems
  - Membrane material characterization

- Environmental application and implication of nanotechnology
  - Antimicrobial activity
  - Toxic effects in biofilm development

- Practical applications
  - Surface water filtration
  - Groundwater treatment and reuse
  - RO desalination
  - Alternative energy solutions

Sustainable water supply

Thesis Topic Ideas/Opportunities

1. Nutrients and clean water recovery from waste for sustainable food production
2. Wildfire impact on drinking water quality and treatment
Teaching

- Daylighting Design
- Parametric Design in Architectural Engineering

Research

Thesis Topic Ideas

**Computer modelling:**
- Analyze the effect of wood finishes (mass-timber buildings) on the indoor lighting environment
- Compare electrochromic glazing strategies in the case of an energy crisis

**Experimental testing:**
- Validate an open-source, low-cost sensor for light measurement and glare assessment
- Test the accuracy and reliability of new wearable light sensors

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