

JEREMY SIMMONS II

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EDUCATION

Ph.D. in Mechanical Engineering

April 2024

University of Minnesota, Twin Cities

Minneapolis, MN

Thesis: "Modeling and Design of Hydraulic Power Take-Offs for Ocean Wave-Powered Reverse Osmosis Desalination"

Committee: Dr. James D. Van De Ven (Advisor), Dr. Thomas Chase, Dr. William Durfee, and Dr. Michele Guala (Civil and Environmental Engineering Department)

M.S. in Mechanical Engineering

November 2020

University of Minnesota, Twin Cities

Minneapolis, MN

B.S. in Mechanical Engineering

May 2017

South Dakota School of Mines and Technology

Rapid City, SD

Final Project: Active Limited-Slip Differential for Off-Road Racing

PROFESSIONAL EXPERIENCE

Resolute Marine Energy Inc.

October 2021 - July 2022

R&D Engineer

Boston, MA

- Oversaw hardware in-the-loop testing of a prototype ocean wave-powered, reverse osmosis desalination system
- Performed model simulations and analyzed experimental and simulation results for validation of mathematical design models
- **Key skills:** project management, control system design, programming (MATLAB), experimentation

Resolute Marine Energy Inc.

September 2017 - July 2020

Contracted Researcher

Boston, MA

- Performed engineering design studies for ocean wave-powered, reverse osmosis desalination system using mathematical system models
- Designed experiments for characterizing hydraulic machine efficiency
- Analyzed system level optimization problems with multiple objectives and constraints
- Designed a feedback control system for regulating hydraulic system pressure
- **Key skills:** model-based machine design, control system design, programming (MATLAB), parallel computing, hydrodynamic modeling

Kimberly-Clark Corporation

January 2016 - July 2016

Mechanical Engineering Co-op

Neenah, WI

- Served as mechanical engineering support for paper converting assets (e.g. feminine and incontinence pads, and adult diapers)
- Troubleshooted mechanical failures and provided design improvements easing operator interaction and solving problems dealing with operator health and safety (esp. noise reduction)
- **Key skills:** detailed design, CAD (SolidWorks, AutoCAD), GD&T, project management, problem solving

Caterpillar Inc.*Engineering Practicum*

February 2015 - August 2015

Rapid City, SD

- Component and system design for internal customer R&D applications (test cells and prototype parts)
- Detailed mechanical design and drawing production with GD&T
- **Key skills:** detailed design, CAD (Creo), GD&T

Hutchinson Technology Inc.*Engineering Co-op*

May 2014 - December 2014

Hutchinson, MN

- Served on an advance process development team working on laser manipulation of stamped sheet metal components
- Tested process and machine changes; statistical analysis; automated data mining; reviewed detailed design and drawings produced for precision machine tooling
- **Key skills:** experimental design, statistical analysis, programming (Visual Basic for Applications), problem solving

RESEARCH EXPERIENCE

Post-Doctoral Researcher*University of Minnesota*

May 2024 - Present

Minneapolis, MN

- A continuation of a project from June 2022 - April 2024 under NSF Cyber-Physical Systems Award No. 2206018.

Graduate Research Assistant*University of Minnesota*

June 2022 - April 2024

Minneapolis, MN

- Design, construct, and test a lab-scale, hardware in-the-loop test bed for ocean wave-powered reverse osmosis and the application of model-predictive control.
- Supported by the NSF Cyber-Physical Systems Award No. 2206018.
- PI: Dr. Jeffrey Scruggs (University of Michigan, Ann Arbor)
- Advisor (Co-PI): Dr. James Van de Ven

Graduate Research Assistant*University of Minnesota, Department of Mechanical Engineering*

September 2021 - December 2021

Minneapolis, MN

- Modeled and studied hydraulic transmission (or "power take-off") architectures for wave-powered, reverse osmosis desalination to determine performance advantages gained using a Variable Displacement Linkage Pump architecture as part of the hydraulic power take-off
- Supported by the Department of Energy SBIR Grant No. DE-SC0019995, "Multi-Stroke Variable Displacement Oscillating Pump for Hydrokinetic Energy" in collaboration with Resolute Marine Energy Inc.
- Advisor (PI): Dr. James Van de Ven

ORISE Fellow*National Renewable Energy Laboratory, Marine Energy Group*

September 2020 - August 2021

Boulder, CO

- Investigated hydraulic transmission (or "power take-off") architectures for wave-powered, reverse osmosis desalination
- Supported by an appointment with Marine and Hydrokinetic Graduate Student Research Program sponsored by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, and Water Power Technologies Office through DOE contract number DESC0014664
- Mentors: Dr. Yi-Hsiang Yu, Dr. Michael Lawson, and Scott Jenne

Graduate Research Assistant
University of Minnesota

September 2017 - July 2020
Minneapolis, MN

- Investigated the application of switch-mode hydraulic circuit architectures for wave-powered, reverse osmosis desalination plants
- Subcontracted researcher on Department of Energy SBIR Grant No. DE-SC0017699, "Wave-Powered Desalination System" in collaboration with Resolute Marine Energy Inc.
- Advisor: Dr. James Van de Ven

Undergraduate Research Assistant
South Dakota School of Mines and Technology

October 2015 - July 2017
Rapid City, SD

- Designed a novel braking actuator and mobile robot for investigating control of mixed actuation system
- Advisors: Dr. Mark Bedillion; Dr. Randy Hoover (Department of Electrical Engineering and Computer Science)

PUBLICATIONS

Simmons, Jeremy W., and James D. Van de Ven. "Design of Hydraulic Power Take-Offs for Wave-Powered Reverse Osmosis Desalination: Meeting Constraints on Pressure Variation", In *2024 Global Fluid Power Society PhD Symposium*. (In print)

Simmons, Jeremy W., and James D. Van de Ven. "A Comparison of Power Take-Off Architectures for Wave-Powered Reverse Osmosis Desalination of Seawater with Co-Production of Electricity", *Energies* 16, no. 21 (2023): 7381.

Simmons, Jeremy W., and James D. Van de Ven. "Limits on the Range and Rate of Change in Power Take-Off Load in Ocean Wave Energy Conversion: A Study Using Model Predictive Control." *Energies* 16, no. 16 (2023): 5909.

Simmons, Jeremy W., and James D. Van de Ven. "Pipeline Model Fidelity for Wave Energy System Models", Proceedings: 2021 ASME/BATH Symposium on Fluid Power and Motion Control, (2021)

Simmons, Jeremy W., and James D. Van de Ven. "Switch-Mode Power Transformer in a Wave-Powered, Reverse Osmosis Desalination Plant", Proceedings: 2019 ASME/BATH Symposium on Fluid Power and Motion Control, (2019)

Simmons, Jeremy W., Walelign M. Nikshi, Mark D. Bedillion, and Randy C. Hoover. "Mechatronic Design of a Mixed Conventional / Braking Actuator Mobile Robot", Proceedings: International Mechanical Engineering Congress and Exposition, (2016)

PATENTS

Simmons, II Jeremy W., and James D. Van de Ven. "Fluid power circuit having switch-mode power transformer and methods." U.S. Patent 11,731,081, issued August 22, 2023.

TEACHING EXPERIENCE

Instructor/Teaching Fellow
University of Minnesota, Twin Cities, ME 3281: System Dynamics and Control

January 2022 - May 2022

- Served as sole instructor of record for junior-level course for mechanical engineering majors with 120 students.
- Developed and delivered lectures on linear system modeling, analysis, and classic feedback control with a focus on practical applications; developed assignments, projects, and exams; hosted office hours; lead three teaching assistant in hosting recitation and office hours and in grading assignments; graded project memos for technical content and technical writing

Teaching Assistant

September 2021 - December 2021

University of Minnesota, Twin Cities, ME 3281: System Dynamics and Control

- Assisted with teaching a junior-level course for mechanical engineering majors with 87 students.
- Assisted with developing assignments and solutions; hosted recitation and office hours; graded homework on technical content
- Instructor of Record: Dr. Perry Li

Teaching Assistant

September 2019 - December 2019

University of Minnesota, Twin Cities, ME 4053: Engineering Modeling

- Assisted with teaching a senior-level technical elective for mechanical engineering majors with 50 students. The course was primarily project based.
- Assisted with developing assignments and project prompts; graded homework and projects on technical content and technical writing; wrote solutions; gave feedback on technical writing; gave a lecture on control system design
- Instructors of Record: Dr. Matt Anderson and Dr. Frank Kelso

Lecturer

September 2018 - September 2019

Minnesota Society of Professional Engineers, Practice of Engineering (PE) exam preparation course

- Lectured for two three-hour webinar sessions (within a larger curriculum that repeated twice a year) on fluid mechanics review, hydraulic machines, and fluid power systems to practicing mechanical engineers studying for a professional licensing exam.

Teaching Assistant

September 2017 - December 2017

University of Minnesota, Twin Cities, ME 4231: Motion Control Lab

- Led one of six weekly lab sessions (8 students each) for mechanical engineering majors.
- Graded lab reports for all lab sessions; gave mini lecture and led class discussions as introduction to review content and lab procedure; held office hours; coached students on problem-solving strategies
- Instructor of Record: Dr. Rajesh Rajamani

MENTORSHIP EXPERIENCE

Big Brother

June 2023 - Present

Big Brother and Big Sisters, Twin Cities

- Volunteering to "develop an impactful relationship with a 'Little', to protect and amplify their potential."

Project Mentor

Fall 2024

University of Minnesota, Twin Cities, ME 4090: Advanced Engineering Problems

- Mentoring an undergraduate student in completing a directed research project for course credit
- Project: Implementing position control of a hydraulic actuator using variable displacement hydraulic pumps as part of a hardware in-the-loop test system for ocean wave-powered reverse osmosis

Graduate Student Mentor

Summer 2023

NSF Research Experiences for Undergraduates

- Provided guidance and mentorship to an undergraduate student during a summer research experience
- Project: Detailed design of a hardware in-the-loop test bed for wave-powered reverse osmosis

Graduate Student Mentor

Summer 2021

NSF Research Experiences for Undergraduates

- Project: Stress and Fatigue Analysis of Reverse Osmosis Membranes

Graduate Student Mentor

Summer 2019

NSF Research Experiences for Undergraduates

- Project: Mathematical Modeling of Hydraulic Check Valves

Math Tutor

Fall 2016 - Spring 2017

*Meadowbrook Elementary School**Rapid City, SD*

- Tutored 3rd grade students. Reviewed incorrect answers with students; reviewed flash cards; talked through reasoning of problems; talked to students about futures in STEM

GRANT/AWARDS

2024 Joachim and Yuko Heberlein Travel Grant Award

2024

*University of Minnesota, Twin Cities***Mechanical Engineering Dept. Teaching Fellowship**

Spring 2022

*University of Minnesota, Twin Cities***Marine and Hydrokinetic Graduate Student Research Program Fellowship**

2020

*Department of Energy, Oak Ridge for Science and Education (ORISE)***Outstanding Senior in Mechanical Engineering**

2017

*South Dakota School of Mines and Technology***Best Walking Joke Book**

2016

*SDM&T SAE Baja Team***Class of '34 Scholarship**

2015

*South Dakota School of Mines and Technology***ADDITIONAL EXPERIENCE**

SAE Baja Technical Leader/Vice President

2017

South Dakota School of Mines and Technology

- Directed engineering design efforts of a high-performing, competitive collegiate off-road racing team

SAE Baja Team Member

2012-2017

South Dakota School of Mines and Technology

- Design, build, test, and compete with an off-road vehicle in a collegiate-level engineering competition
- Projects included: (1) detailed design of a gearbox for actuation of an actively controlled continuously variable transmission, (2) design of a actively controlled limited slip differential, and (3) on-track experiments with an open differential compared to sold axle characterizing over-steer/under-steer behavior
- **Key skills:** teamwork, machine design, manufacturing (milling, turning, welding, water-jet cutting, 3D printing, thermal forming), vehicle dynamics, experimentation, data acquisition, micro-controllers, project management

SKILLS

Computing:

MATLAB/Simulink, C/C++; Parallel computing,
SLURM workload manager; LINUX operating systems

Hardware:

PIC microcontrollers; Arduino; National Instruments DAQ

Drafting/CAD/CAM:

Ansys Fluent; SolidWorks, Creo, AutoCAD; Mastercam; GD&T

Miscellaneous:

Conventional and CNC machining, Welding,
Vertical machining center (VMC) operation;
GIMP (2D image manipulation); Inkscape (vector graphics)