

AIDAN JOHN FURLONG

aidfurlong@gmail.com — (407) 388-8894 — linkedin.com/in/aidanfurlong

EDUCATION

North Carolina State University, Raleigh, NC Expected: May 2024
M.S. in Nuclear Engineering GPA: 4.00
Thesis: “Predicting Fuel Assembly Crud Susceptibility using Convolutional Neural Networks” (*in progress*)

University of Florida, Gainesville, FL May 2022
B.S. in Nuclear Engineering GPA: 3.31
Honors: *Cum Laude*

RESEARCH AFFILIATIONS

Artificial Intelligence for the Simulation of Advanced Nuclear Systems Group Raleigh, NC
Graduate Research Assistant Jan. 2023 - Present

- Major areas: Convolutional Neural Networks (CNNs), Uncertainty Quantification (UQ), Transfer Learning (TL).
- Advisor: Dr. Xu Wu.

Florida Multiphysics Modeling and Simulation Group Gainesville, FL
Undergraduate Research Assistant Sep. 2020 - Apr. 2023

- Major areas: Convolutional Neural Networks (CNNs), Data-driven Modeling, Reactor Physics.
- Advisor: Dr. Justin Watson.

PROFESSIONAL EXPERIENCE

Westinghouse Electric Company Cranberry Township, PA
Radiation Engineering & Analysis Intern May 2023 - Aug. 2023

- Transitioned pressure vessel fluence validation benchmarks to the current discrete ordinates methodology.
- Overhauled in-house SERPENT/MCNP interface script to add enhancements and optimize resource use.
- Modeled as-built Vogtle Unit 4 hatches in MCNP to provide updated radiation field estimates.

Palo Verde Nuclear Generating Station Tonopah, AZ
Nuclear Analysis Intern May 2022 – Jul. 2022

- Investigated the use of a fresh center assembly as a replacement option instead of a typical twice-burnt assembly.
- Produced a viable design for surviving three consecutive cycles using SIMULATE, with a technical report of findings accepted for use by PVNGS.
- Performed control rod lifetime calculations for the upcoming reload campaign.

Inyo Pool Products Longwood, FL
Customer Service Representative May 2019 – Aug. 2020

- Placed orders, coordinated with vendors, and regularly contributed to the technical Q&A thread.
- Achieved the highest customer satisfaction rating with the highest volume of interactions in a department of 15.

PROJECTS

Prediction of Crud-Induced Power Shift Raleigh, NC
Artificial Intelligence for the Simulation of Advanced Nuclear Systems Group Jan. 2023 - Present

- Developed a CNN-based framework to quickly and accurately predict the CIPS susceptibility of a modeled core’s fuel assemblies.
- Trained using a combination of calculated and measured data from the Catawba Nuclear Station, the model can predict CIPS instances with an accuracy of 92% in under 4.3 seconds.
- Uncertainty Quantification was performed using Monte Carlo Dropout (MCD) to assess the model’s prediction confidence.

PWR Neutronics Predictions using Neural Networks Gainesville, FL
Florida Advanced Multiphysics and Simulation Group Sep. 2020 - Apr. 2023

- Investigated the use of neural networks in the prediction of neutronics features such as pin powers and k -eigenvalues.
- Using the in-house CNN framework, single-assembly pin power and multiplication factors predictions can be made within 0.5% deviation from OpenMC-calculated values while using a tenth of the computational expense.
- This work was geared towards developing methods for the acceleration of conventional neutronics codes.

Neutronics of a SMR Core for Puerto Rican Deployment Gainesville, FL
Coursework - Senior Design Nov. 2021 - May 2022

- Made design decisions for core geometry, loading pattern, and reactivity control for a small modular paper reactor.

- Found a viable 22-month equilibrium cycle using CASMO/SIMULATE while adhering to all safety and performance limits.
- Thermal hydraulic, safety, and balance-of-plant analyses performed with other team members.

Fast Flux Test Facility Isotopic Modeling

Florida Advanced Multiphysics and Simulation Group

Gainesville, FL
Feb. 2021 - Apr. 2022

- In support of a graduate student, modeled radial concentrations of various nuclides in generic assemblies using SERPENT.
- Compared calculations with experimental data to estimate assembly-specific as-operated power histories.

Modeling Historical PWRs with OpenMC

Coursework - Nuclear Materials

Gainesville, FL
Feb. 2021 - Apr. 2021

- Simulated core from the early-era modular PM-3A “Antarctica Reactor” using OpenMC.
- Validated model accuracy using historical technical reports and measurements.
- Investigated the use of modernized corrosion-resistant materials on neutronics parameters.

SKILLS

- **Relevant Coursework:** Scientific Machine Learning, Mathematical Modeling, Uncertainty Quantification, Nuclear Fuel Performance.
- **Languages:** Python, MATLAB, C++, Linux, L^AT_EX.
- **Nuclear Codes:** CASMO/SIMULATE, DOORS, MCNP, MOOSE, OpenMC, SERPENT.
- **Software:** Excel, Word.

MEMBERSHIP

- American Nuclear Society (ANS).

PUBLICATIONS

1. **Furlong, A.**, Alsafadi, F., Palmtag, S., Godfrey, A., Hayes, S., and Wu, X. (2024). The Prediction of Crud-Induced Power Shift Susceptibility in PWR Fuel Assemblies using Convolutional Neural Networks. (*in preparation*)
2. **Furlong, A.**, Alsafadi, F., Palmtag, S., Godfrey, A., Hayes, S., and Wu, X. (2024). Predicting PWR Fuel Assembly CIPS Susceptibility with Convolutional Neural Networks: Performance and Uncertainty Quantification. (*under review at Proceedings of the International Conference on Physics of Reactors - PHYSOR 2024*)
3. **Furlong, A.**, and Watson, J. (2023). Predicting PWR Assembly Temperature Coefficients with the LatticeNet Neural Network Framework. (*in revision at Annals of Nuclear Energy*)
4. **Furlong, A.**, Alsafadi, F., Kohler, L., Wu, X., Palmtag, S., Godfrey, A., and Hayes, S. (2023). Machine Learning-based Prediction of Crud Buildup Locations in Pressurized Water Reactors. *Transactions of the American Nuclear Society*.
5. **Furlong, A.**, and Watson, J. (2023). Investigation of Monte Carlo Trained CNNs for Neutronics Predictions of Typical and Atypical PWR Assemblies. (*accepted, in press at Progress in Nuclear Energy*)
6. **Furlong, A.**, Shriver, F., and Watson, J. (2022). Using neural networks to predict pin powers in reflective PWR fuel assemblies with varying pin size. In *Proceedings of the International Conference on Physics of Reactors - PHYSOR 2022*.