Paul W. Talbot

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EDUCATION

Doctor of Philosophy, Nuclear Engineering
University of New Mexico, Albuquerque, New Mexico, GPA 4.08 December 2016
Thesis - Advanced Stochastic Collocation Methods for Polynomial Chaos in RAVEN

- Researched, implemented multidimensional sparse grid sampling techniques
- Distribution-specific polynomial fitting for uncertain variables
- Vast statistical convergence improvement demonstrated for continuous responses
- Development in Object-Oriented Python (RAVEN framework, github.com/idaholab/raven)
- Software quality assurance, version control (Git)
- Intership, Idaho National Laboratory

Master of Science, Nuclear Engineering
Oregon State University, Corvallis, Oregon, GPA 3.75 March 2013
Thesis - Extending the Discrete Maximum Principle for the IMC Equations

- Research, implemented theoretical maximum for implicit Monte Carlo
- Improved solve strategy for nonlinear photon transport
- Intership, Los Alamos National Laboratory

Bachelor of Science, Physics
BYU-Idaho, Rexburg, Idaho, GPA 3.84 April 2010

- Investigate down-blended vs fresh UO2 performance in BWR assembly
- CASMO4, MICROBURN-B2, ALLADIN benchmarking
- Power shapes, pin peaking, design limits
- Intership, AREVA NP in Richland, WA

PROFESSIONAL EXPERIENCE

Idaho National Laboratory, Idaho Falls, ID

Principle Investigator 2020 - Present

- *FORCE Software Development (github.com/idaholab/FORCE)*
  Identified priority research directions for modeling and simulation efforts across multiple Department of Energy (DOE) research programs, including Integrated Energy Systems and Light Water Reactor Sustainability. Negotiated scope of work with DOE managers for yearly project activities. Balanced labor and funding to execute yearly scope across multiple DOE programs and laboratories. Interviewed candidates for management, staff, postdoctoral, and internship positions. Led training for various software within Framework for Optimization of Resources and Economics (FORCE) tool suite. Presented work at conferences, both within energy industry and other industries such as data centers. Engaged with university, laboratory, and industry in leading or supporting proposals for new funding opportunities, including Nuclear Energy University Partnership (NEUP), Technology Commercialization Fund (TCF), Office of Clean Energy Demonstration (OCED), Gateway for Advanced Innovation in Nuclear (GAIN), and Advanced Research Projects Agency-Energy (ARPA-E).

Lead Software Developer 2017 - 2020

- *HERON (github.com/idaholab/HERON)*
  Led a small team of developers in implementing HERON, a Python-based object-oriented plugin of RAVEN for stochastic techno-economic optimization of grid-energy systems. Planned, designed, and

deployed software under continuous-deployment version control and software quality assurance. Provided training and deployed plugin for analyses of novel integrated energy system technologies in several markets, with partner industries, other national laboratories, and universities. Hosted interns annually and trained new staff in development practices.

- *2021 LDRD awarded: Signal processing for cybersecurity*
  Managed a 3-year $1.5M project including lab and university researchers to explore using high/low order correlation for false data injection detection in physical process signals, including toolset software development and demonstration on experimental systems.

Individual Contributor 2014 - 2017

- *Sparse grid collocation for generalized polynomial chaos*
  As part of doctorate work, extended RAVEN sampling and reduced-order model methods to include sparse grid collocation sampling for multidimensional polynomial surrogate models. Demonstrated strengths and weaknesses of algorithm on several analytic as well as real-world problems.
- *Developer, RAVEN (github.com/idaholab/raven)*
  Trained new users and developers in RAVEN as well as orchestrated signifcant new development and reworks of several systems in RAVEN as needs adjusted, managing performance in both memory and speed. Responded frequently to user queries, offering guidance or implementing code changes. Reviewed proposed code changes for software quality assurance, iterating with developers to improve code contributions.
- *Python, LaTeX, C++, Conda, Bash*

Internships

- INL: 2012, 2010, MOOSE and MARMOT regression testing
- LANL: 2011, Discrete maximum principle for iMC equations
- AREVA: 2009, 2008 BLEU effective enrichment research

COMPUTING SKILLS

Extensive use of Python (Conda, Pandas, Xarray, SKLearn, Statsmodels), Git, Bash
Experience with C++, MatLab, Visual Basic

SAMPLE PUBLICATIONS

- H. Wang, R. Ponciroli, A. Alfonsi, P. Talbot, T. Elmer, A. Epiney, R. Vilim, "Feasible Actuator Range Modifier (FARM), a Tool Aiding the Solution of Unit Dispatch Problems for Advanced Energy Systems," Energies 2024; vol 17 no. 12 part F; pp 2945. https://doi.org/10.3390/en17122945
- P. Talbot, D. McDowell, B. Rolston, T. Lewis, "Signal Decomposition for Intrusion Detection in Reliability Assessment in Cyber Resilience Summary Report," INL report INL/RPT-23-74252, Idaho National Laboratory, 2023.
- M. Basnet, J. Bryan, S. Dana, A. Meek, H. Wang, P. Talbot, "Stochastic Optimization and Uncertainty Quantification of Natrium-Based Nuclear-Renewable Energy Systems for Flexible Power Applications in Deregulated Markets," preprint, available at http://ssrn.com/abstract=4552930.
- K. Frick, D. Wendt, P. W. Talbot, et al, "Technoeconomic Assessment of Hydrogen Cogeneration via High Temperature Steam Electrolysis with a Light-Water Reactor," Applied Energy 2022; vol 306 part B, pp. 118044. https://doi.org/10.1016/j.apenergy.2021.118044
- Y. Li, A. Sundaram, HS. Abdel-Khalik, P. W. Talbot, "Real-Time Monitoring for Detection of Adversarial Subtle Process Variations," Nuclear Science and Engineering 2022; pp. 1024. https://doi.org/10.1080/00295639.2021.1997041
- R. R. Flanagan, P. W. Talbot, et al, "Isolating cloud induced noise to improve generation of synthetic surface solar irradiances," Advances in Applied Energy 2021, vol 3, pp. 100045.

https://doi.org/10.1016/j.adapen.2021.100045

- P. W. Talbot, C. Rabiti, et al, "Correlated Synthetic Time Series Generation using Fourier and ARMA signal processing," Int. J. Energy Res. 2020; 1-12. https://doi.org/10.1002/er.5115
- A. Epiney, C. Rabiti, P. Talbot, et al, "Economic analysis of a nuclear hybrid energy system in a stochastic environment including wind turbines in an electricity grid", Applied Energy 2020; 260, 114227
- K. Frick, P. Talbot, et al, "Evaluation of Hydrogen Production Feasibility for a Light Water Reactor in the Midwest", INL report INL/EXT-19-55395, 2019
- A. Epiney, C. Rabiti, P. Talbot, et al, "Case Study: Nuclear-Renewable-Water Integration in Arizona", INL report INL/EXT-18-51369, 2018
- P. W. Talbot, "Advanced Stochastic Collocation Methods for Polynomial Chaos in RAVEN,", Ph. D. Dissertation, Department of Nuclear Engineering, University of New Mexico, December 2016
- P. W. Talbot, C. Wang, et al, "Multistep Input Reduction for High Dimensional Uncertainty Quantification in RAVEN Code," ANS PHYSOR 2016
- P. W. Talbot, K. Gamble, et al, "Time-Dependent Sensitivity Analysis of OECD Benchmark using BISON and RAVEN," 2016 ANS winter conference transactions
- P. W. Talbot, A. K. Prinja, C. Rabiti, "Adaptive Sparse-Grid Stochastic Collocation Uncertainty Quantification Convergence for Multigroup Diffusion," 2016 ANS annual conference transactions
- C. Wang, P. W. Talbot, et al, "An efficient Sampling-Based Method for Sensitivity and Uncertainty Analysis through RAVEN," 2016 ANS annual conference transactions
- P. W. Talbot, A. K. Prinja, C. Rabiti, "High Density Model Reduction Uncertainty Quantification for Multigroup Diffusion Neutronics," 2015 ANS M&C topical conference transactions
- P. W. Talbot, A. K. Prinja, "Sparse-Grid Stochastic Collocation Uncertainty Quantification Convergence for Multigroup Diffusion," 2014 ANS winter conference transactions
- P. W. Talbot, "Extending the Discrete Maximum Principle for the IMC equations," Oregon State University masters thesis, September 2012
- P. W. Talbot, A. B. Wollaber, T. Palmer, "Implementing a Discrete Maximum Principle for the IMC Equations," 2012 ANS general conference transactions, M & C division

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- OSTI: `https://www.osti.gov/search/orcid:0000000296729044`
- Publons (reviews): `https://publons.com/researcher/3839497/paul-talbot/`

MEMBERSHIPS

- Reviewer:
  - *Applied Energy*
  - *Energies*
  - *Mathematics*
  - *Nuclear Science and Engineering*
  - *Nuclear Technology*
- Conference reviewer: ANS, ANS M&C
- Technical Program Committee, ANS M&C 2019
- Member, American Nuclear Society

References available on request.