Dan Walsh

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Computational physicist specializing in structure-preserving PDE solvers and ML-driven control systems for industrial optimization. Expertise in data science, numerical validation and solvers, and deploying physics-based models.

Skills

scientific computing: finite differences, structure-preserving discretization, grid convergence, Vlasov–Poisson solver, nonlinear eigenvalue problems, dimensional reduction, partial and ordinary differential equations
modeling and optimization: numerical optimization, mixed-integer programming, model predictive control, parameter estimation, gray-box modeling, Bayesian model fitting, mass and energy balances, thermodynamics and statistical physics
machine learning: TensorFlow, Keras, scikit-learn
software engineering: Python, Go, TypeScript, pytest, mypy, scientific software engineering

Professional Experience

Founding Scientist at **CrossnoKaye**, *Santa Barbara, California* 2019 - present
Developed foundational scientific methods, models, software, and control algorithms as we grew the company from zero to over 110 deployments across the US.

- Ideated and implemented the original OSP and OHP Energy AI applications, bridging theoretical models of refrigeration with closed-loop control and optimization of real, deployed systems.
- Architected the general-purpose Python application framework for cloud-based Energy AI deployments, conducting integration debugging and validation while working with our platform team to build out the underlying infrastructure.
- Co-developed equipment-level power and thermal physics-based models to complement the energy AI applications, enabling real-time energy optimization of compressors, condensers, and evaporators, while directly implementing bug fixes and features.
- Co-created COSMIC – originally a hackathon project – devising the mathematical theory and formulation as a mixed-integer programming model for optimal compressor sequencing, implementing it in Pyomo for optimization.
- Built a physics-based pepperoni-drying model in Python to simulate moisture migration and surface evaporation via the diffusion equation, validating against experimental data and using it to optimize the drying process.

Graduate Research Student, The Nonneutral Plasma Group at **University of California, San Diego** 2013 - 2018

- Developed a Vlasov-Poisson solver using structure-preserving discretization to calculate Bernstein modes, replacing dense Green's-function formulations with sparse coupled equations to eliminate artificial spectral growth.
- Validated numerical results against WKB theory and experimental data, correcting spurious frequency shifts by implementing exact cold-fluid response and verifying grid convergence in radius, speed, and gyroharmonic count.
- Solved nonlinear eigenvalue problems for finite-length diocotron modes using dimensional reduction and secant root-finding, deriving an effective fluid description to predict temperature-dependent frequency shifts.

Education

PhD in Physics, University of California, San Diego 2018

MS in Physics, University of California, San Diego 2012

BS in Physics, University of California, Santa Barbara, College of Creative Studies 2011