Isaac Rose

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PROFILE

Senior multiphysics simulation and modeling engineer applying machine learning, surrogate modeling, and automation to complex hardware systems. 10+ years of experience building FEA/CFD workflows, physics-based models, DOE pipelines, and validation methods that connect simulation and test data to engineering decisions. Builds and deploys engineering software for internal teams and external customers, turning advanced models into practical applications and integrated workflows.

ENGINEERING EXPERIENCE

Penske Racing Shocks

2021-Present

Senior Performance Engineer

- Built a CAD-to-FEA surrogate-modeling workflow integrating parametric geometry, DOE and parallel ANSYS execution, response extraction, neural-network training, optimization, adaptive sampling, and dyno-data correlation to predict force-response behavior.
- Developed Python and MATLAB pipelines for simulation and test-data processing, model fitting, validation scoring, holdout comparison, diagnostic plotting, model comparison, and sensitivity analysis.
- Developed and deployed a Python-based damper modeling platform used by professional teams to generate force-velocity curves across large configuration spaces and integrate calibrated models with Dymola/Modelica system simulations.
- Built internal software for damper model specification, test planning, validation review, licensing, and controlled publishing, enabling technicians to create and release production models.
- Built and validated an ML application supporting neural networks, Gaussian processes/Kriging, XGBoost, random forests, and iterative surrogate-guided DOE loops that refit models and select new FEA design points; established end-to-end validation by correlating FEA with experimental data, surrogate predictions with FEA, and surrogate outputs with independent dyno data.
- Developed Python-backed engineering applications with Blazor/.NET and Streamlit front ends, integrating domain logic, modeling workflows, and validation methods into internal and customer-facing tools.
- Developed coupled fluid-structure and time-domain system models capturing pressure-driven flow, structural compliance, valve mechanics, and nonlinear response under quasi-static loading.
- Built and standardized Penske's structural analysis framework, defining FEA modeling practices, material allowables, and elastic, plastic, thermal, and fatigue failure criteria used to support new design sign-off.
- Conducted nonlinear structural and fatigue analyses and topology-driven optimization for production racing hardware, supporting a Formula 1 damper design that reduced mass by approximately 15% while maintaining durability and performance targets.
- Developed material characterization and testing methods to improve structural modeling inputs and validation
- Mentored junior engineers in advanced FEA methodology, fatigue modeling, and simulation validation.

QuantaCool Corporation

2025

Simulation Consultant

- Supported structural validation of thermosyphon-based CPU cold-plate hardware for high-performance computing and data-center cooling applications.
- Evaluated design risk, fatigue survivability, and manufacturability-sensitive tradeoffs to guide prototype hardware decisions.
- Identified structural sensitivities and recommended design changes that reduced bottom-plate thickness while maintaining required safety margins, de-risking the design before prototype testing.

Materials Research & Design **2016-2021**

Senior Research Engineer / Research Engineer

- Developed multiphysics simulation frameworks combining CFD, thermal conduction, and structural mechanics to evaluate hypersonic vehicle survivability across mission profiles.
- Directed modeling strategy for phase-change cooling systems applied to hypersonic leading-edge structures, selecting materials based on thermal performance, structural compatibility, and mission constraints.
- Predicted aerothermal heating and structural response using high-fidelity CFD and correlated structural models to define viable flight-condition envelopes.
- Conducted statistical analyses on oxide-oxide material-property variation to quantify mission-level effects for hypersonic vehicle applications.
- Analyzed high-strain-rate material behavior in Split Hopkinson pressure bar testing and correlated models to experimental data.
- Designed a chemical vapor deposition chamber for carbide-based coatings of carbon-carbon composites using coupled FEA/CFD methods.
- Developed a 2D CFD model to predict heat generation and fluid flow in a gas turbine engine.

NovaTherm Research Laboratory **2014-2016**

Villanova Graduate Research Assistant

- Developed and validated transient thermal models of large-scale water storage systems integrated into chiller-less data-center cooling architectures.
- Evaluated system-level performance impact of thermal-energy storage integration for data-center cooling applications.
- Published peer-reviewed research in the ASME Journal of Thermal Science and Engineering Applications.

Villanova University Formula SAE **2012-2016**

Powertrain Lead

- Led a four-person powertrain team responsible for cooling, lubrication, drivetrain, fuel, and intake systems for a Formula-style race vehicle.
- Built a predictive radiator model to size the cooling system and support powertrain design decisions.
- Developed a MATLAB lap-simulation tool to evaluate vehicle performance as a function of weight, power, and grip.
- Performed ANSYS Fluent CFD analysis of intake geometry to optimize airflow and engine performance.

EDUCATION

Villanova University, Villanova, PA **2014, 2016**

BS and MS in Mechanical Engineering, Minor in Physics

TECHNICAL SKILLS

Software and Data: Python, MATLAB, Streamlit, C#, .NET, Blazor Server, ASP.NET Core, MongoDB, JSON, HDF5, Git, Azure DevOps

Simulation: ANSYS Mechanical, Fluent, MAPDL, Abaqus, COMSOL, Modelica/Dymola, Simulink, nonlinear FEA, fatigue, CFD, fluid-structure interaction

ML and Optimization: surrogate modeling, neural networks, Gaussian process/Kriging, XGBoost, random forests, Optuna, DOE, adaptive sampling, bayesian optimization, model validation