RICARDO MARQUEZ, Ph.D.

Physical Systems Modeling · Probabilistic Reasoning · Scientific Software

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Summary

Engineer and software developer with fifteen years building physical models and the production software around them, across power systems, weather and environmental modeling, forecasting and engineering simulation. Work sits where physical models, imperfect measurements, uncertain operating conditions and computational limits meet, and has to produce an engineering decision. Comfortable owning a problem end to end: the mathematics, the simulation, the data pipeline, the service architecture and the question the operator actually needs answered.

Areas of Expertise

- Probabilistic inference & UQ
- Bayesian modeling & diagnosis
- Physical & numerical simulation
- Thermal, fluid & hydrologic models
- Transmission & DLR/AAR
- Weather modeling & forecasting
- Renewables: solar and wind
- Grid operations & EMS integration
- Scientific software architecture
- REST services & dashboards
- Cloud and on-premise delivery
- Geospatial & time-series data

Professional Experience

Software Engineer / Machine Learning Engineer — July 2024 – present

Pitch Aeronautics

- Design and implement machine-learning and inference systems combining weather, terrain and field-sensor telemetry for real-time decisions on sensor systems and power-line operations.
- Build operational weather and transmission-line modeling services, with uncertainty carried through to the delivered quantity.
- Develop software supporting dynamic line ratings and transmission monitoring.
- Deploy scalable modeling and inference services for utility applications.

Founder — November 2023 – August 2024

Terrabyte Analytics

- Founded and led a company for environmental data modeling, forecasting and decision systems in energy and infrastructure, covering data ingestion, modeling, product strategy and client delivery.
- Originated TERRA, a framework for probabilistic reasoning over physical systems, now an ongoing independent research and software project (see Selected Project).

Software Solution Architect — January 2019 – November 2023

WindSim Power

- Led architecture and development of simulation and modeling platforms for renewable energy and electric transmission, combining scientific computing with cloud-ready product design.
- Extended the core computational platform with thermal models of overhead transmission lines, the basis of dynamic and ambient-adjusted line ratings.
- Built web dashboards and REST services that put ratings, weather and sensor data in front of operators.
- Integrated transmission sensors and utility systems, and supported utility DLR/AAR pilot projects.

Project Engineer / Software Developer — January 2015 – December 2018

GEI Consultants, Inc.

- Improved a river-routing and flood-forecasting desktop application used for emergency response.
- Built web applications for financial resource planning across water-resource projects and programs.
- Produced and analyzed evapotranspiration raster datasets feeding groundwater models and water-demand estimation.

Senior Scientist — August 2013 – November 2014

Forecast Energy

- Developed electric-load and solar-power forecasting algorithms and the applications around them.
- Built pipelines integrating real-time and forecast weather from public sources into operational databases.

Postdoctoral Researcher, and Research Assistant 2008 – 2013

University of California, Merced

- Maintained and extended radiation heat-transfer models in Fortran and C++, reaching higher accuracy at lower computational cost.
- Advanced state-of-the-art techniques for solar irradiance forecasting: satellite image processing, optimization and statistical forecasting models in MATLAB.
- Teaching assistant in aerodynamics: curriculum and laboratory development, examination and grading.

Selected Project

TERRA — probabilistic reasoning for complex physical systems 2023 – present

Independent research and software

- A framework that couples physical simulation to probabilistic inference: estimating system state, weighing competing explanations for what a plant is doing, quantifying risk, and identifying which measurement would resolve the remaining doubt.
- Carried across power systems, data-center cooling, water distribution, district energy and battery storage, with more than a hundred runnable case studies and thirty built technical papers whose every number is read from a committed result.
- Example: on a chilled-water loop with twelve competing explanations, the correct diagnosis rose from third place at 11 % to first at 57 % after the single follow-up measurement the framework recommended. In a sensor-fault benchmark it identified the corrupted channel in 4 of 4 scenarios, against 2 of 4 for a peer-comparison baseline and 0 of 4 for alarm thresholds.

Education

Ph.D., Mechanical Engineering and Applied Mechanics 2012

University of California, Merced

B.S., Environmental Engineering 2008

University of California, Merced

Technical Environment

Languages	Python, Java, TypeScript/JavaScript, MATLAB, C/C++, Fortran, SQL
Frameworks	Spring, Angular, NumPy/SciPy, scikit-learn, pandas
Data	PostgreSQL/PostGIS, MySQL, Microsoft SQL, Oracle, time-series and geospatial data, QGIS
Infrastructure	AWS, Docker, Linux, Tomcat, CI pipelines
Methods	Bayesian inference, graphical models, uncertainty quantification, Monte Carlo, optimization, numerical simulation

Certifications

- Project Management Professional (PMP)
- iSAQB Certified Professional for Software Architecture — Foundation Level
- CompTIA Security+
- ISO 27001 Lead Implementer