

PSimPy - Predictive and probabilistic simulation with Python



Hu Zhao, Anil Yildiz, Nazanin Bagherinejad, Julia Kowalski

Chair of Methods for Model-based Development in Computational Engineering, RWTH Aachen University, Germany

Gaussian Process, Multiphysics Simulation

Simulate & Emulate

Scale up your simulator in just a few steps

- Plug in your simulator via a Python wrapper
- Run serial or parallel without changing your model
- Train a Robust GP emulator to mimic your simulator's outputs
- Use the emulator as a lightweight substitute for fast evaluations

Quant. uncertainty

Identify key drivers. Calibrate with data.

- Run sensitivity analysis using Sobol indices
- Sample efficiently using Saltelli, LHS, or Metropolis Hastings
- Estimate posterior distributions using Bayesian Inference
- Use active learning to choose the most informative next simulations

**Want to build unified,
robust and sustainable
UQ workflows? [1]**

PSimPy

- Set up a Bayesian problem
- Kick off with a small batch of simulations and a GP Emulator
- Active learning automatically picks the next input points to improve calibration
- Estimate the posterior from the emulator and visualize it
- Estimate the posterior from the emulator and visualize it

Bibliography

- [1] H. Zhao, A. Yildiz, N. Bagherinejad, and J. Kowalski, "PSimPy: GP emulation-based sensitivity analysis, uncertainty quantification and calibration of landslide simulators," in *14th International Conference on Applications of Statistics and Probability in Civil Engineering, ICASP14*, Dublin, Ireland, 2023.

Example

Bibliography