**Abstract**

**Industrial experience deploying heterogeneous platforms for use in**

**multi-modal power systems design workflows**

We will present our industrial experience deploying software and heterogeneous hardware platforms to support end-to-end workflows in the power systems design engineering space. Such workflows include classical physics-based HPC simulations, GPU-based ML training and validation, as well as pre- and post-processing on commodity CPU systems.

The software architecture is characterized by message-oriented middleware which normalizes distributed compute assets into a single ecosystem. Services provide enterprise authentication, data management, version tracking, digital provenance, and asynchronous event triggering, fronted by a RESTful API, Python SDK, and monitoring GUIs. With the tooling, various classes of workflows from simple, unitary through complex multi-modal workflows are enabled. The software development process was informed by and uses several national laboratory software packages whose impact and opportunities will also be discussed.

Utilizing this architecture, automated workflow processes focused on complex and industrially relevant applications have been developed. These leverage the asynchronous triggering and job distribution capabilities of the architecture to greatly improve design capabilities. The physics-based workflows involve simple Python-based pre-processing steps, proprietary Linux-based physics solvers, and multiple HPC steps. Post-processing via proprietary Fortran and Python scripts are used to generate training data for machine learning algorithms. Physics model results were then provided to machine learning algorithms on GPU compute nodes to optimize the system based on design criteria. Finally, the optimized results were validated by running their designs through the physics-based workflow.

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