Contribution ID: **1**   Type: **Keynote**

Exascale fission and fusion applications

Monday, July 29, 2024 11:00 AM (40 minutes)

Advanced nuclear energy holds promise as a reliable, carbon-free energy source capable of meeting our nation's commitments to addressing climate change. A wave of investment in fission and fusion power within the United States and around the world indicates an important maturation of academic research projects into the commercial space. The design, certification, and licensing of novel reactor concepts pose formidable hurdles to the successful deployment of new technologies. The high cost of integral-effect nuclear experiments necessitates the use of high-fidelity numerical simulations to ensure the viability of nuclear energy in a clean energy portfolio.

Building on our previous work, we will target simulations significantly larger than competing work in our field, and only with capability computing and exascale-level resources can these insights be gained. We NekRS, a GPU-oriented version of the Nek5000 code, to scale to the full Frontier machine.
In particular, We discuss several high-fidelity simulation capabilities developing unprecedented insight into large-scale multi-physics phenomena. We discuss full-core hybrid Reynolds Averaged Navier Stokes (RANS) and Large Eddy Simulation (LES) of fission reactors conducted on Frontier. Simulation of unprecedented scale have also been conducted on a fusion energy systems (CHIMERA).

Relevance for Nek [100 words max]

We discuss modeling of large fission and fusion systems using NekRS

Primary author: MERZARI, Elia (Penn State)

Co-authors: YUAN, Haomin; Dr MIN, Misun; Dr FISCHER, Paul; KERKEMEIER, Stefan; NGUYEN, Tri; Mr LAN, Yu-Hsiang

Presenter: MERZARI, Elia (Penn State)