

The tail wags the dog – How in situ processing and data modeling will enable knowledge extraction at scale to address the 2030 CFD

Steve M. Legensky

Typically, CFD data analysis and visualization is an afterthought and at the back end of "the dog"; in order to fully exploit the knowledge contained in simulations at exascale, the tail needs to wag the dog. Simply writing ever larger files containing mesh and results will not scale when it comes to extracting knowledge from simulations. Inspired by early NASA researchers and the Department of Energy's national labs, mechanisms for processing results directly via "in situ" or "in transit" techniques are adopted for large scale CFD workflows. This talk will review applications of those technologies and how they may impact our ability to achieve the 2030 goals in knowledge extraction and Uncertainty Quantification. In addition, data modeling and analysis may play a key role in directly extracting the knowledge buried in large unsteady CFD simulations and experiments. We will explore where further developments are needed to fully exploit techniques such as Dynamic Mode Decomposition, Machine Learning and other Reduced Order Model methodologies.