Fast multilevel multi-phase CFD-nodal model for cryogenic applications

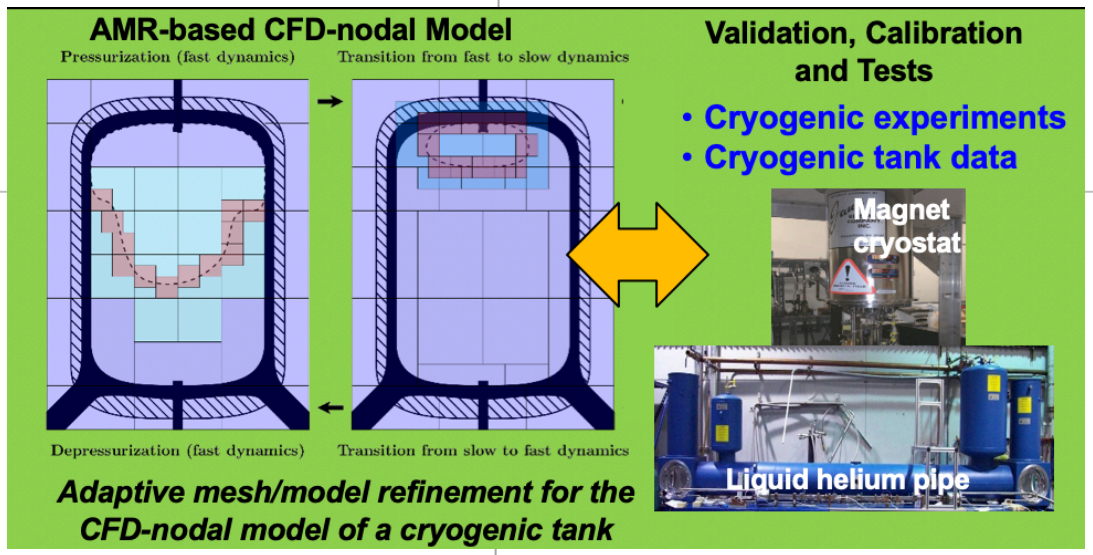
- **PI:** Prof. **Kourosh Shoele,** Florida A&M Univ.-Florida State Univ. College of Engineering (FAMU-FSU CoE)
- **Co-PIs:** Prof. **Wei Guo** FAMU-FSU CoE; Prof. **Mark Sussman,** Florida State University

Topic 6 - Integration of Cryogenic Fluid Two Phase Numerical Modeling Techniques

Research Objectives:

- A validated fast model for design of cryogenic storage systems for multiple space-time scales,
- Automated physics-based switch between the low-fidelity nodal and high-fidelity CFD models,
- Elimination of uncertainties in the heat transfer and phase-changes near the boundaries,
- Integration with NASA design software,

•TRL advance from 3.5 to 5.



Adaptive mesh/model refinement for the CFD-nodal model of a cryogenic tank

Approach

- Block-structured adaptive mesh refinement (AMR) framework for combining CFD and nodal models,
- Automatic and adaptive connection between models based on the desired level of accuracy versus speed,
- Extensive validation, verification and calibration during the development.

Potential Impact:

•Flexible framework design of cryogenic tanks,

- Novel design procedure for settled and unsettled conditions,
- Response map for different storage & transport cryogenic applications,
- Improved modeling/design capabilities at NASA.