Safe and Efficient Hydrogen Combustion through Data-Driven Burner Design

Enabling Industries through Surrogate Optimization and additive manufacturing

Motivation and Relevance

- Rising demand for hydrogen burners requires safe, efficient designs.
- Flashback risk and emissions challenge conventional methods.
- Additive manufacturing enables advanced geometries and faster innovation.

Approach

- Surrogate optimization combining CFD, and AM constraints.
- Automated loop with Dakota–Salome–OpenFOAM for rapid design iteration.
- Objective: minimize hydrogen–air mixture inhomogeneity

Results

- >80 % less simulation effort vs. classical DOE.
- Identified key sensitivities influencing mixing uniformity.
- Improved mixing uniformity resulting in reduced flashback risk and lower NO_x emissions.

Research Area

- Hydrogen
- Data-Driven Design
- Surrogate Optimization

Partners

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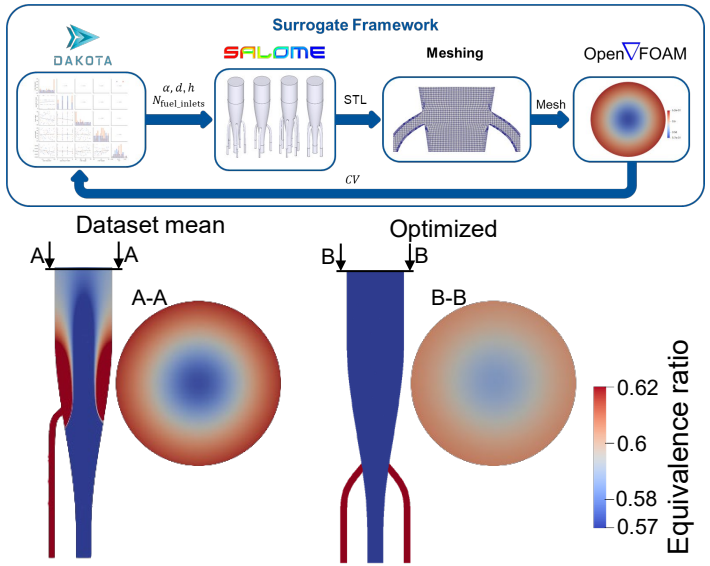
SPP 2419 HyCAM Hydrogen-based fuel combustion using additive manufacturing

Picture



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