

## Role of multiphase CFD simulations in the design & development of a novel hybrid atomizer

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### ABSTRACT

Fuel atomizers are highly specialized devices that play a crucial role in the functioning and performance of aero gas turbine engines. Their technical specifications include stringent requirements related to atomization and spray structure, low operation and maintenance costs, high reliability of operation, and tight geometrical constraints among others. From a fuel atomization point of view, the primary challenge is the task of atomizing the fuel effectively throughout the wide range of flow rates in which the engine operates, with good sensitivity to changes in the flow rates. This seminar will elucidate the role that multiphase computational fluid dynamics (CFD) can play in the development of a novel hybrid atomizer. The novel atomizer being developed combines the functionality of a pilot, pressure-swirl atomizer at start-up and another main atomizer (typically an air-blast atomizer) to operate during the remainder of the flight. The use of CFD to model the resulting spray and its characteristics provides an invaluable tool in aiding the development of the atomizer. The internal and near nozzle flow for the pressure-swirl atomizer was modeled using a Volume-of-Fluid (VOF) approach with High Resolution Interface Capture (HRIC) to track the interface. The numerical predictions of the spray cone angle when compared with experimental data obtained using laser-based shadowgraphy showed excellent agreement. The main atomizer spray was modeled using an Eulerian-Lagrangian approach where the liquid phase is assumed to consist of a number of parcels which are tracked using a Lagrangian framework. This seminar will describe such state-of-the-art simulations used to model the hybrid atomizer and design decisions that were made to improve its performance using reliable CFD results.

### ABOUT THE SPEAKER

Dr. Jacob Koshy is an Institute of Eminence post-doctoral research fellow in the Combustion & Spray Laboratory (CSL) working under the mentorship of Prof. R. V. Ravikrishna. His current research interests include the numerical and experimental studies of multiphase flows. Following a two-year stint working in the industry for ABB Limited, Dr. Jacob pursued his masters and doctoral degrees from the Indian Institute of Technology Kharagpur. His doctoral thesis focused on the significance of non-Boussinesq effects in natural convection of non-Newtonian fluids.

