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Large Eddy Simulations for Flow Blurring Twin-Fluid Atomization Concept Using Volume of Fluid Method

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Abstract : The present study is mainly focusing on the numerical simulation of Flow Blurring (FB) twin fluid injection concept was proposed by Ganan-Calvo, which involves back flow atomization based on global bifurcation of liquid and gas streams, thus creating two-phase flow near the injector exit. The interesting feature of FB injector spray is an insignificant effect of variation in atomizing air to liquid ratio (ALR) on a spray cone angle. Besides, FB injectors produce a nearly uniform spatial distribution of mean droplet diameter and are least susceptible to variation in thermo-physical properties of fuels, making it a perfect candidate for fuel flexible combustor development. The FB injector working principle has been realized through experimental flow visualization techniques only. The present study explores potential of ANSYS Fluent based Large Eddy Simulation(LES) with volume of fluid (VOF) method to investigate two-phase flow just upstream of injector dump plane and spray quality immediate downstream of injector dump plane. Note that, water and air represent liquid and gas phase in all simulations and ALR is varied by changing the air mass flow rate alone. Preliminary results capture two phase flow just upstream of injector dump plane and qualitative agreement is observed with the available experimental literature.

Keywords : flow blurring twin fluid atomization, large eddy simulation, volume of fluid, air to liquid ratio
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