Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Liquid film breakup induced by turbulent shear flow MELISSA KOZUL, NTNU, PEDRO COSTA, KTH, JAMES R. DAWSON, NTNU, LUCA BRANDT, KTH — Gas turbine engines commonly employ prefilming airblast atomizers for liquid fuel injection. Supplied from holes or slits upstream, the liquid fuel forms a thin film over the prefilming surface before being driven to the atomizing edge by a turbulent flow through the turbine. The use of a second air stream on the other side of the prefilmer to prevent fuel accumulation means the breakup and eventual atomization of the liquid film occurs in the shear zone formed by the co-flowing air streams (Aigner & Wittig, J. Eng. Gas Turbines Power (1988) vol. 110, pp. 105 - 110). We consider a simplified numerical setup using a recently developed volume of fluid method (Ii et al., J. Comput. Phys. (2012) vol. 231, pp. 2328 - 2358) to simulate this multiphase problem. A liquid film is sandwiched between sheared turbulent gas flows from a precursor simulation, which serve to deform and then rupture the liquid film. The simplified setup allows us to systematically vary parameters such as film thickness and turbulent gas flow Reynolds number to gauge the effect upon momentum transfer into the initially stationary liquid film. Understanding and controlling the route to breakup and atomization of liquid fuels in such systems is of primary practical concern in modern gas turbine engine design.

Melissa Kozul
NTNU

Date submitted: 01 Aug 2019 Electronic form version 1.4