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Optimization of pulsed jets in crossflow¹ RAJES SAU, KRISHNAN MAHESH, University of Minnesota — Recent experiments (M'Closkey et al. 2002, Shapiro et al. 2006, Johari 2006, Eroglu & Briedenthal 2001) on pulsed jets in crossflow show that jet penetration and spread can be optimized at specific pulse conditions. We performed DNS to study the evolution and mixing behavior of jets in crossflow with fully modulated square wave excitation. We attempt to explain the wide range of optimal pulsing conditions found in different experiments. Pulsing generates vortex rings. Sau and Mahesh (J. Fluid Mech., 2008) show that vortex rings in crossflow exhibit three distinct flow regimes depending on stroke ratio and velocity ratio. We use the behavior of a single vortex ring in crossflow to explain the evolution of pulsed jets in crossflow. Simulations suggest that the optimal conditions can be predicted from the transition between different regimes of vortex rings. It is observed that the duty cycle modifies the optimal conditions depending on the interaction in the near field. Simulation results and comparison with experiments will be discussed.

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