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Parameter dependences of the onset location of turbulent liquid jet breakup[1] ALAN KERSTEIN, AMIRREZA MOVAGHAR, Chalmers Univ., MARK LINNE, Univ. of Edinburgh, MICHAEL OEVERMANN, Chalmers Univ. — A previous study of primary breakup of turbulent liquid jets obtained a $We^{-0.67}$ dependence of breakup onset location on jet Weber number We based on reasonable agreement with measurements and closeness to a theoretical prediction $We^{-2/5}$ inferred from inertial-range phenomenology [1]. It is proposed that breakup onset is instead controlled by the residual presence of the boundary-layer structure of the nozzle flow in the near field of the jet. Assuming that the size of the breakup-inducing eddy is within the scale range of the log-law region, We^{-1} dependence is predicted. This dependence agrees with the measurements more closely than the $We^{-0.67}$ dependence. To predict the dependence on Reynolds number Re, either the friction velocity based on the Blasius friction law or the bulk velocity can be used, where the former yields $Re^{3/8}$ dependence and the latter implies no Re dependence. The latter result is consistent with measurements, but not with the boundary-layer interpretation of breakup onset, so the origin of the measured lack of Re dependence merits further investigation. A preliminary assessment has been made using a computational model of primary breakup. [1] P.-K. Wu, G. M. Faeth, Phys. Fluids 7, 2915 (1995).

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