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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