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A SIMPLIFIED MODEL FOR THE EVOLUTION OF THE DROP SIZE DISTRIBUTION IN AN EMULSION UNDER STRONG-FLOW CONDITIONS

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A theoretical study is presented on the evolution of a drop size distribution in an emulsion under strong flow conditions where drop breakup dominates drop coalescence. Previous experiments and numerical simulations demonstrate that the size of daughter drops produced by breakup in a particular fluctuation scale with the critical size drop for the fluctuation; the volume of the parent drop only determines the number of daughter drops produced by the breakup event. A simplified population balance model predicated on this observation is presented. The essential simplification involves the replacement of the usual two-variable daughter-drop distribution function by a single-variable distribution that describes the volume of daughter drop relative to the critical size drop. Analytical solutions of the simplified population balance are obtained for the case where breakup events produce a mono-disperse distribution of daughter drops.