

Analytical solution of the droplet breakup equation by the Adomian decomposition method

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Abstract

The droplet population balance equations (PBEs), which despite its importance rarely has an analytical solution. However, few cases with assumed functional forms of breakup rate, daughter droplet distribution exist, where most of these solutions are for the batch stirred vessel. A new framework for solving (PBEs) for batch and continuous systems is proposed in this work, which uses the Adomian decomposition method. This technique overcomes the crucial difficulties of numerical discretization and stability that often characterize previous solutions in this area. The technique used in this work has been tested for the droplet breakup equation. The solutions are presented for several cases, for which analytical solutions are available, for batch and continuous systems for droplet breakup in stirred vessels. In all cases, the predicted droplet size distributions converge exactly in a continuous form to that of the analytical solution.

Keywords : Population balance model; Droplet breakup; Adomian decomposition method.

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