Mass conserving global solutions for the nonlinear collision-induced fragmentation model with a singular kernel

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Abstract

This article is devoted to the study of existence of a mass conserving global solution for the collision-induced nonlinear fragmentation model which arises in particulate processes, with the following type of collision kernel:

\[ C(x,y) \sim k_1 \frac{(1 + x) \nu (1 + y) \nu}{(xy) \sigma}, \]

for all \( x, y \in (0, \infty) \), where \( k_1 \) is a positive constant, \( \sigma \in \left[0, \frac{1}{2}\right] \) and \( \nu \in [0, 1] \). The above-mentioned form includes many practical oriented kernels of both \textit{emph{singular}} and \textit{emph{non-singular}} types. The singularity of the unbounded collision kernel at coordinate axes extends the previous existence result of Paul and Kumar [Mathematical Methods in the Applied Sciences 41 (7) (2018) 2715–2732 (\href{https://doi.org/10.1002/mma.4775}{doi:10.1002/mma.4775})] and also exhibits at most quadratic growth at infinity. Finally, uniqueness of solution is also investigated for pure singular collision rate, i.e., for \( \nu = 0 \).

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