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Non-Markov effects in intersecting sprays MAHESH PANCHAGNULA, DHIVYARAJA KUMARAN, SRI VALLABHA DEEVI, ARUN TANGIRALA, Indian Inst of Tech-Madras — Sprays have been assumed to follow a Markov process. In this study, we revisit that assumption relying on experimental data from intersecting and non-intersecting sprays. A phase Doppler Particle Analyzer (PDPA) is used to measure particle diameter and velocity at various axial locations in the intersection region of two sprays. Measurements of single sprays, with one nozzle turned off alternatively are also obtained at the same locations. This data, treated as an unstructured time series is classified into three bins each for diameter (small, medium, large) and velocity (slow, medium, fast). Conditional probability analysis on this binned data showed a higher static correlation between droplet velocities, while diameter correlation is significantly alleviated (reduced) in intersecting sprays, compared to single sprays. Further analysis using serial correlation measures: auto-correlation function (ACF) and partial auto-correlation function (PACF) shows that the lagged correlations in droplet velocity are enhanced while those in the droplet diameter are significantly debilitated in intersecting sprays. We show that sprays are not necessarily Markov processes and that memory persists, even though curtailed to fewer lags in case of size, and enhanced in case of droplet velocity.

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