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Image processing and edge detection techniques to quantify regular to irregular shock wave transition obtained from experiments[1]
LINGZHI ZHENG, presenter, BENJAMIN KATKO, BARRY LAWLOR, CLAIRE MCGUIRE, JANE ZANTESON, KEVIN NGUYEN, VERONICA ELIASSON, coauthor — Experimental studies of multiple shock wave interaction to study transition from regular to irregular reflection rely on the processing of a large amount of schlieren photographs. Here we present an automated algorithm to track individual shock fronts and triple points. First, correction to any optical distortions is applied to the photographs. Next, noise removal and edge detection algorithms are implemented to extract the pixel locations of the shocks. The edge detection algorithm takes advantage of shock waves' light intensity feature to distinguish shock fronts from background noise. This algorithm is also capable of separating entangled shock fronts through pattern recognization, which utilizes a discretization method to reduce complex shock geometries to localized linear patterns. Collectively, the algorithms can track shock wave characteristics to sub-pixel precision. Extractable characteristics include positions and propagation velocities of shock fronts, vertical and horizontal velocities of the Mach stem, and triple point trajectories during shock interactions. This algorithm can process large volumes of data with minimal manual operations, making image processing more efficient and productive.

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