Event-Based Cameras for Efficient (and Cost-Effective !) PIV Applications

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Particle Image Velocimetry (PIV) and Particle Tracking Velocimetry (PTV) are critical techniques for flow visualization in experimental fluid mechanics. However, the implementation of these methods often requires expensive equipment and generates vast quantities of data.

Recently, a new type of camera, known as an "event-based camera" or "neuromorphic camera," has become available. Unlike conventional cameras, event-based cameras do not record images but instead detect changes in intensity at each pixel asynchronously and independently. This novel approach drastically reduces data volume while achieving an equivalent acquisition rate of 10 kHz. Additionally, these cameras are significantly more affordable, costing approximately ten times less than traditional PIV systems.

In our study, we develop experimental methods and algorithms designed for event-based cameras to measure 2D Eulerian velocity fields. This approach demonstrates the potential of event-based cameras as an efficient, cost-effective alternative for flow visualization in fluid dynamics research.