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The Temporal Resolution of Laser Induced Fluorescence Photobleaching Anemometer[1] WEI ZHAO, University of South Carolina, FANG YANG, Carnegie Mellon University, GUIREN WANG, University of South Carolina
— Recently, in microfluidics, electrokinetic flows are widely used on micromixer designing. However, there is unfortunately no valid velocimeter today that can measure the random velocity fluctuation at high temporal and spatial resolution simultaneously in the complicated flow circumstance. We recently introduced laser induced fluorescence photobleaching anemometer (LIFPA), which has been successfully used in the measurement of velocity field in AC electrically driven microflow. Here, we theoretically study the temporal resolution (TR) of and experimentally verify, LIFPA can have simultaneously ultrahigh temporal ($\sim$4 μs) and spatial ($\sim$203 nm) resolution and can measure velocity fluctuation up to at least 2 kHz, whose corresponding wave number is about 6×10^6 1/m in an electrokinetically forced unsteady flow in microfluidics. The measurement of LIFPA is also compared with the widely used micro Particle Imaging Velocimetry (μPIV). We found, at the inlet, due to multiple uncertainties, the velocity fluctuations by μPIV exhibits apparently smaller values than that by LIFPA. But at downstreams, where velocity fluctuation is much lower than at the inlet and the uncertainties of complicated electric field on particles becomes smaller, LIFPA and μPIV indicate similar measurement.

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