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Direct background-oriented schlieren tomography SAMUEL GRAUER, ADAM STEINBERG, Georgia Institute of Technology — We present a novel approach to background-oriented schlieren (BOS) tomography that combines the deflection sensing and reconstruction algorithms. BOS imaging is a refraction-based flow visualization technique. Simultaneous BOS measurements from multiple cameras can be reconstructed by computed tomography to estimate the fluid's 3D refractive index field, which is post-processed to obtain local densities. Each camera is focused on a textured background pattern that is positioned behind the fluid. Density gradients cause distortions in the image; the deflected light trajectories are typically determined using an optical flow algorithm. These deflections constitute the projection data for reconstruction. Deflection sensing is itself a complex inverse problem and a primary source of error in BOS tomography. We propose an alternative measurement model for BOS tomography that incorporates the optical flow equation. The deflection model is extended to calculate image gradients, directly, such that the refractive index field is reconstructed from the distorted images. As a result, reconstructions must satisfy observed gradients instead of inferred deflections, which are prone to error. The talk describes our measurement model and presents a numerical assessment of direct BOS tomography.

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