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Measuring bubbles in a bubbly wake flow[1] SEUNG-JAE LEE, ELLISON KAWAKAMI, ROGER E.A. ARNDT, Saint Anthony Falls Laboratory, University of Minnesota — This paper presents measurements of the velocity and size distribution of bubbles in a bubbly wake. This was carried out by utilizing particle shadow velocimetry (PSV). This technique is a non-scattering approach that relies on direct in-line volume illumination by a pulsed source such as a light-emitting diode (LED). A narrow depth-of-field (DoF) is required for imaging a 2-dimensional plane within a flow volume. Shadows of the bubbles were collected by a high-speed camera. Once a reference image, taken when no bubbles were present in the flow, was subtracted from the images, the image was segmented using an edge detection technique. The Canny algorithm was determined to be best suited for this application. A curvature profile method was employed to distinguish individual bubbles within a cluster of highly overlapping bubbles. The utilized algorithm was made to detect partly overlapping bubbles and reconstruct the missing parts. The movement of recognized individual bubbles was tracked on a two dimensional plane within a flow volume. In order to obtain quantitative results, the wake of a ventilated hydrofoil was investigated by applying the shadowgraphy technique and the described bubble detection algorithm. These experiments were carried out in the high speed cavitation tunnel at Saint Anthony Falls Laboratory (SAFL) of the University of Minnesota.

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