Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Accuracy of Velocity Estimation Using Global Variational Methods DOUG BOHL, NARATIP SANTITISSADEEKORN, ERIK BOLLT, Clarkson University — In this work a method of processing digital images, such as those from PIV, MTV, or LIF, for flow velocities using Global Variational Method (GVM) is investigated. This technique is based on principles of Frobenius-Perron (FP) operator theory in which image sequences can be related to the infinitesimal generator of the FP operator to motivate a flow-recovery constraint. A regularization method is then used to minimize this constraint along with an additional constraint required to stabilize a solution. Synthetic images, with typical MTV tagging patterns, and variable noise levels were first created and then displaced using analytically derived flow fields. Displacements were calculated from pairs of images and the error was determined by comparing the measured displacements to those of the analytical flow field. A direct correlation technique (DCT) was also used to process the synthetically derived images for comparison. Results show that the GVM error levels are nominally 5-10 times higher than for the DCT. While the error is higher for GVM compared to DCT the results show potential for using this technique to provide quantitative flow measurements in cases where DCT cannot be applied.

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Date submitted: 28 Jul 2008 Electronic form version 1.4