Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

A vision-based hybrid particle tracking velocimetry (PTV) technique using a modified cascade-correlation peak-finding method W.H. TIEN, Y.C. LEI, J. DUNCAN, D. DABIRI, University of Washington, T. RÖSGEN, ETH Zurich , J. HOVE, University of Cincinnati, M. GHARIB, California Institute of Technology — In this talk we present new algorithms for particle identification and particle tracking velocimetry (PTV). The new particle identification algorithm uses both the Cascade Cross-correlation Method (CCM) and 2-D surface Gaussian fitting to overcome the issue of overlapping particles. Simulation with up to 5% noise shows particles can be located with errors under 0.07 pixels for overlap ratios up to 50%. The new PTV method, taking advantage from vision theory, is developed to map from a "proximity" matrix to a "pairing" matrix while inherently satisfying the exclusion principle. The validity of the results is ensured by hybridization with PIV data, and the reliability of the method is further tested by adding noise to synthetic data. The proposed method gives reliability values up to 99.9% at particle densities up to 0.06 for a simulated moving wall flow, an oscillating wall flow and an Oseen vortex. Variations in particle intensity and diameter are also tested with simulated flow images. An experimental shear layer image pair is then tested, proving the robustness of the proposed method. Furthermore, it is shown that kriging interpolation in combination with PTV results can accurately resolve velocity gradients such as the wall region.

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Date submitted: 09 Aug 2010 Electronic form version 1.4