Calibration model

Polynomial mapping function (3rd order in x and y, 2nd order in z; Soloff et al 1997)
or pinhole camera model (Tsai et al 1987)
or any other (please provide a description of the model and possibly a reference).

Image pre-processing

Background removal by sliding minimum on kernel 15x15

Gaussian smoothing on kernel 3x3 with standard deviation 1.

Min-max normalization on kernel 15x15 and desired contrast set to 1000.

etc…

3D particles reconstruction (triangulation, tomography, etc)

Algorithm: SMART (Mishra et al 1999)
Number of iterations: 10
Smoothing between the iterations with Gaussian filter 3x3x1 (Discetti et al 2013).
etc.

PIV interrogation (cross-correlation, least-square approaches, etc.)

Algorithm: Volume deformation interrogation

Final interrogation volume size: 2.0x2.0x2.0mm (40x40x40 vox at 20vox/mm)

Interrogation method: cross-correlation with FFT predictor estimation and fast direct correlations on the last iterations (Discetti & Astarita 2012). Blackman window filtering in cross-correlation (Astarita 2007). Smoothing applied in between each iteration with top hat filtering of the dense predictor on a region equal to the interrogation volume.

Validation: universal median criterion on 5x5x5 kernel (threshold 2 vox);

Outliers replacement: Quadratic interpolation on 5x5x5 kernel.

Data post-processing

Smoothing on 3x3x3 kernels with a Gaussian filter, etc.

References

Astarita T (2007) Analysis of weighting windows for image deformation methods in PIV. Exp Fluids 43:859-872

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Mishra D, Muralidhar K, Munshi P (1999) A robust MART algorithm for tomographic applications. Num Heat Transfer Part B 35:485–506

Soloff SM, Adrian RJ, Liu ZC (1997) Distortion compensation for generalized stereoscopic particle image velocimetry. Meas Sci Technol 8:1441-1454

Tsai RY (1987) A versatile camera calibration technique for high accuracy 3D machine vision metrology using off-the-shelf TV cameras and lenses. IEEE J Rob Autom 4(RA-3):323-344