Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Data assimilation method to de-noise and de-filter particle image velocimetry data[1] ROLAND BOUFFANAIS, Singapore University of Technology and Design, JURRIAAN J. J. GILLISSEN, University College London, DICK K. P. YUE, Massachusetts Institute of Technology — We present a variational data assimilation method in order to improve the accuracy of velocity fields $\tilde{\mathbf{v}}$, that are measured using particle image velocimetry (PIV). The method minimizes the space-time integral of the difference between the reconstruction $\mathbf{u}$ and $\tilde{\mathbf{v}}$, under the constraint, that $\mathbf{u}$ satisfies conservation of mass and momentum. We apply the method to synthetic velocimetry data, in a two-dimensional turbulent flow, where realistic PIV noise is generated by computationally mimicking the PIV measurement process. The method performs optimally when the assimilation integration time is of the order of the flow correlation time. We interpret these results by comparing them to one-dimensional diffusion and advection problems, for which we derive analytical expressions for the reconstruction error.

[1]This work is partially funded by the SUTD-MIT International Design Center

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Date submitted: 31 Jul 2019 Electronic form version 1.4