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Divergence-free filtering and pressure determination from 3D velocimetry: applications to flows of industrial and biomedical relevance DANIELE SCHIAVAZZI, University of California at San Diego, FILIPPO COLETTI, JULIEN BODART, JOHN K. EATON, Stanford University — Methodologies to acquire three-dimensional velocity fields are becoming increasingly available. However unavoidable experimental errors limit the possibility of exploiting the data to extract further information. We recently introduced a noise reduction algorithm which eliminates spurious divergence in incompressible flow measurements, removing about fifty percent of the Gaussian noise. Here we apply the algorithm to the mean velocity field in an inclined jet in crossflow measured by Magnetic Resonance Velocimetry. The de-noised field is used to calculate the mean pressure distribution by integrating the Reynolds-averaged momentum equation. A simple eddy-viscosity model is used for the estimation of the Reynolds stresses. The results are compared with a highly resolved Large Eddy Simulation of the same configuration. It is argued that filtering of the spurious noise can be critical to obtain a correct evaluation of the pressure field. Applications to biomedical flows are also discussed. Results are presented for in vivo cardiac flow measurements as well as in vitro velocimetry in a model of human airways.

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