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Multi-planar velocimetry for 3D reconstruction of the flow AHMAD FALAHATPISHEH, Department of Mechanical and Aerospace Engineering, University of California, Irvine, CA, USA, GIANNI PEDRIZZETTI, Dipartimento Ingegneria Civile e Architettura, Università di Trieste, Italy, ARASH KHERADVAR, Department of Mechanical and Aerospace Engineering, University of California, Irvine, CA, USA — Several extensions of PIV have been proposed for measurements of 3D fields which are restricted for full-volume quantification. We have introduced a fundamentally different solution for experimentally characterizing the incompressible and time-periodic flows in 3D, such as those found in the cardiovascular system. 2D velocity data, acquired by 2C-PIV in multiple planes, is reconstructed to a 3D velocity field taking advantage of the incompressibility of the flow. Using 2D samples instead of scanning the entire 3D domain leads to higher temporal/spatial resolutions since each slice is acquired in a 2D fashion. Hence, there is the possibility of extension to other (medical) imaging modalities that cannot employ advanced 3D optical techniques. 2C-velocimetry on two perpendicular stacks is used for 3D interpolation. The interpolated velocity field is then corrected to satisfy the incompressibility constraint by adding an irrotational velocity field that projects the velocity into a divergence-free vector field space. The method has been validated by exemplary flows having both compact and non-compact structures and different levels of noise. The results show improvements in the reliability of the reconstructed vector field. Application to cardiac flow is also verified.

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