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Instantaneous Pressure Field Calculation from PIV Data with Least-Square Reconstruction JIACHENG ZHANG, CARLO SCALO, PAVLOS VLACHOS, Purdue Univ — A method using least-square reconstruction of instantaneous pressure fields from PIV velocity measurements is introduced and applied to both planar and volumetric flow data. Pressure gradients are computed on a staggered grid from flow acceleration. An overdetermined system of linear equations which relates the pressure and the computed pressure gradients is formulated. The pressure field is estimated as the least-square solution of the overdetermined system. The flow acceleration is approximated by the vortex-in-cell procedure, providing the pressure field from a single velocity snapshot. The least-square method is compared against the omni-directional pressure gradient integration and solving the pressure Poisson equation. The results demonstrate that the omni-directional integration and the least-square method are more robust to the noise in velocity measurements than the pressure Poisson solver. In addition, the computational cost of the least square method is much lower than the omni-directional integration, and very easily extendable to volumetric data retaining computational efficiency. The least-square method maintains higher accuracy than the pressure Poisson equation while retaining a similar computational burden.

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