Advances in laser-based flow diagnostics for the measurement of velocity, pressure and temperature

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DOI
10.1088/1361-6501/ab4920

Publication date
2020

Document Version
Final published version

Published in
Measurement Science and Technology

Citation (APA)
Discetti, S., & Scarano, F. (2020). Advances in laser-based flow diagnostics for the measurement of velocity, pressure and temperature. *Measurement Science and Technology*, *31*(4), Article 040101. https://doi.org/10.1088/1361-6501/ab4920

EDITORIAL

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IOP Publishing
Measurement Science and Technology
Meas. Sci. Technol. **31** (2020) 040101 (2pp)
https://doi.org/10.1088/1361-6501/ab4920

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Editorial

Advances in laser-based flow diagnostics for the measurement of velocity, pressure and temperature

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This volume of *Measurement Science and Technology* contains a special feature section with selected papers from the 19th International Symposium on Applications of Laser and Imaging Techniques to Fluid Mechanics, held in Lisbon, Portugal from 16 to 19 July 2018. The proceedings of the whole symposium are available online at www.lisbonsimposia.org.

The special feature puts together research articles within the common denominator of non-intrusive, laser-based velocimetry for fluid flows. The applications of laser and imaging techniques is not limited solely to velocimetry, and they include integrating laser-based velocimetry with field measurements of thermodynamic quantities such as temperature and pressure, thus spanning a wider range of fluid flow variables. This is a key step towards the development of advanced flow measurement tools, capable of providing a more complete description for diagnostics, validation of models and of numerical simulations.

The fundamental aspects of the experimental uncertainties related to the simultaneous measurement of velocity and temperature by cross-correlation Rayleigh scattering are covered in the work of Boyda *et al* [1]. The dependence upon illumination and imaging of temperature measurements by thermochromic liquid crystals is discussed in the article of Moller *et al* [2].

Density field measurement approaches are compared in the article of Klemkowsky *et al* [3], where the plenoptic imaging and background oriented schlieren are applied to a thermal plume.

Several techniques aiming at determining the fluid flow pressure from PIV-based measurements are presented for a variety of flow problems: spray-induced pressure field (Kling *et al* [4]); pressure gradient error detection and correction techniques in a vortex shedding regime (McClure and Yarusevych [5]); and pressure field inside droplets in pore-flow (Ansari *et al* [6])

Finally, data assimilation is a research area receiving increased attention as of late. The work of Neeteson and Rival [7] illustrates the use of a state-observer approach to inject experimental observations into a numerical simulation of the fluid flow problem.

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References

[1] Boyda M, Byun G and Lowe K T 2019 Investigation of velocity and temperature measurement sensitivities in cross-correlation filtered Rayleigh scattering (CCFRS) *Meas. Sci. Technol.* **30** 044004
[2] Moller S, Konig J, Resagk C and Cierpka C 2019 Influence of the illumination spectrum and observation angle on temperature measurements using thermochromic liquid crystals *Meas. Sci. Technol.* **30** 084006
[3] Klemkowsky J N, Clifford C J, Bathel B F and Thurow B S 2019 A direct comparison between conventional and plenoptic background oriented schlieren imaging *Meas. Sci. Technol.* **30** 064001

[4] Kling N, Kriegseis J, Opfer L and Rogler P 2019 Pressure evaluation of spray-induced flow in the framework of a statistical approach based on URANS and ensemble averaging *Meas. Sci. Technol.* **30** 084004
[5] McClure J and Yarusevych S 2019 Generalized framework for PIV-based pressure gradient error field determination and correction *Meas. Sci. Technol.* **30** 084006
[6] Ansari S, Yusuf Y, Sabbagh R and Nobes D S 2019 Determining the pressure distribution of a multi-phase flow through a pore space using velocity measurement and shape analysis *Meas. Sci. Technol.* **30** 054004
[7] Neeteson N J and Rival D E 2019 State observer-based data assimilation: a PID control-inspired observer in the pressure equation *Meas. Sci. Technol.* **31** 014003