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Holographic Particle Tracking Velocimetry (20150264, Dr. Jiarong Hong)

IP Status: Issued US Patent; **Application #:** 15/422,021

3D Flow Measurements: From Microfluidics To Wall-Bounded Turbulence

The digital inline holographic particle tracking velocimetry (DIH-PTV) processing package enables high-fidelity flow measurements for a wide range of applications ranging from microfluidics to turbulent channel flows. The 3D PTV technology provides accurate, cost effective, full 3D measurement of particle concentration and velocity for gaseous and liquid flows with minimal human intervention required. By harnessing the massive parallel computing capabilities of modern multi-core GPUs, the computational speed for extraction of particle fields and corresponding velocity field calculations from holograms (i.e., 2D images of particle fringe patterns) are reduced dramatically (e.g. 1-5 minutes/vector field). This 3D particle image velocimetry measurement solution offers high spatial resolution, works with highly a concentrated tracer field, and requires minimal alignment so it is easy to use.

For more information and to view a video, visit the Holographic PIV website.

MN-IP Try and Buy

Try

- $5,000 for a twelve month trial
- Trial fee is waived for MN companies or if sponsoring $50,000+ research with the University
- No US patent costs during trial

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- $25,000 conversion fee (TRY to BUY)
- Royalty rate of 3% (2% for MN company)
- Royalty free for first $1M in sales

Improved Holographic Velocimetry

Traditional holographic imaging faces limitations such as poor longitudinal resolution, human intervention, limited tracer concentration, small sampling volume and expensive computations. This DIH-PTV technology overcomes these challenges through an image processing package comprised of more than ten major steps (e.g. 3D computational deconvolution, iterative particle extraction). The DIH-PTV technology uses a low-power light source and a single camera, which significantly lowers the system cost. Furthermore, state-of-the-art 3D PIV techniques like Tomographic PIV and V3V do not apply to micro-scale flow measurement cases, but this technology applies to both micro-scale flow measurement cases as well as laboratory scale channel flow cases. Notably, DIH-PTV could provide comparable spatial resolution and sampling volume sizes to other the-state-of-the-art 3D whole-field flow measurement techniques.

Technology ID
20150264

Category
Engineering & Physical Sciences/Instrumentation, Sensors & Controls

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BENEFITS AND FEATURES:

- Full 3D measurement
- Significantly lower cost
- High spatial resolution (both lateral and longitudinal)
- Works with highly concentrated tracer fields
- Minimum human intervention
- Very compact and easy to use

APPLICATIONS:

- 3D velocimetry field measurements in micro flow devices as well as turbulent channel flow cases
- Medical imaging systems (e.g. tracking and imaging red blood cells)
- Chemical and biological sensors
- Particle counters and size analyzers

Phase of Development - Prototyped and generating data.

Researchers

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Publications

High fidelity digital inline holographic method for 3D flow measurements
Optics Express, Vol. 23, Issue 21, pp. 27159-27173 (2015)
Improvements on digital inline holographic PTV for 3D wall-bounded turbulent flow measurements: smooth- vs. rough-wall
Measurement Science and Technology, Toloui et al, 2017, Meas. Sci. Technol.
Development of High Fidelity Digital Inline Holographic Particle Tracking Velocimetry for 3D Flow Measurements
University of Minnesota, Doctoral Thesis, Toloui, 2016