Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Holographic astigmatic particle tracking velocimetry (HAPTV)[1]
ZHOU ZHOU, College of Ocean and Atmospheric Sciences, Ocean University of China, SANTOSH KUMAR SANKAR, KEVIN MALLERY, Dept. of Mech. Engineering, UMN, CHENG LI, SAFL, UMN, WENSHENG JIANG, College of Env. Sci. & Engineering, JIARONG HONG, Dept. of Mech. Engineering, UMN — The formation of twin images in digital inline holography (DIH) is the main issue that constrains the placement of the focal plane in the center of the sample volume for DIH-based particle tracking velocimetry (DIH-PTV) with a single camera. As a result, it is challenging to apply DIH-PTV for flow measurements in large-scale laboratory facilities and many field applications despite its low cost and compact setup. Here we introduce holographic astigmatic PTV (HAPTV) by inserting a cylindrical lens in the optical setup of DIH-PTV which generates distorted holograms. Such distortion is subsequently utilized in a customized reconstruction algorithm to distinguish tracers positioned on different sides of the focal plane located in the center of a sample volume. Our HAPTV approach is calibrated under different magnifications, and is implemented to measure a vertical jet flow and the channel flow in a large-scale water tunnel. The results are compared with measurements from conventional particle image velocimetry and show a good agreement. The work has demonstrated that HAPTV can achieve improved spatial resolution compared to the conventional astigmatic PTV, and also enable the implementation of DIH-based PTV to flows in field applications.

[1]Chinese Scholarship Council & Ocean University of China

Zhou Zhou
College of Ocean and Atmospheric Sciences, Ocean University of China

Date submitted: 30 Jul 2019 Electronic form version 1.4