TIME-RESOLVED STEREO-PIV MEASURMENTS DOWNSTREAM OF A CIRCULAR CYLINDER

TSI APPLICATION NOTE SPIV-009 (A4)

Introduction

A study was conducted in the TSI® closed return water channel with a test section of approximately 400 × 100 × 100 mm of the flow 195 mm downstream of a vertically-mounted rigid cylinder at *Re* = 2000. Both the cylinder and the stereo-PIV field of view were coincident with the centerline of the water channel.

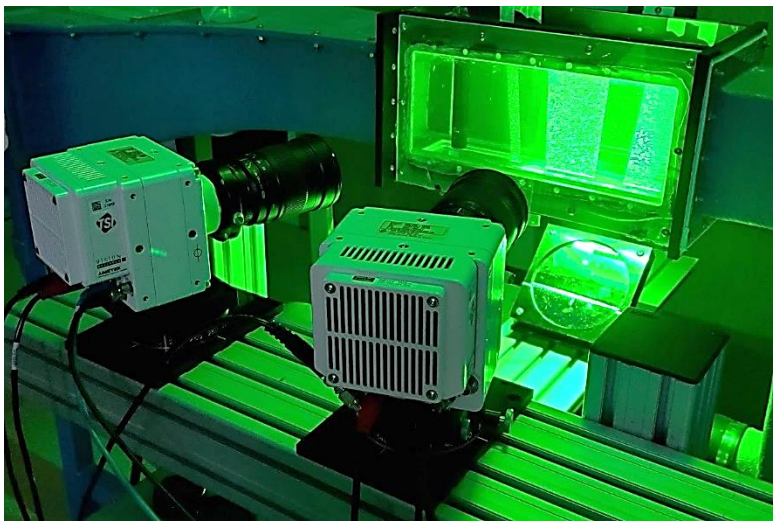

Figure 1
The Stereo-PIV system capturing data in the water channel downstream of a circular cylinder.

Experimental Setup

The experimental setup consisted of two 630100-18 GB cameras with a pixel resolution of 2560 × 1600 and a frame rate of 800 fps at full pixel resolution.

The cameras were fitted with 135 mm lenses and Scheimpflug mounts. The experiments conducted here were captured at a frame rate of 400 fps. The laser was a 1000 Hz dual-head Nd:YLF laser with 20 mJ/pulse. Sheet optics formed the circular laser beam into a sheet with thickness of approximately 1 mm. The laser was positioned beneath the water channel and the light sheet was then reflected off of a 45-degree mirror up through the bottom of the water channel to illuminate the central plane. The field of view of the overlapping regions of the stereo-PIV arrangement was 80 × 45 mm. The timing of the camera image capture and the laser pulses was controlled with a 610036 Synchronizer with timing jitter of 250 ps. A photo of the experimental setup can be seen in Figure 1.

Results

INSIGHT4G™ software (version 11) was used to both capture the stereo-PIV images as well as analyze the results. A calibration was performed by capturing a single image from each camera of a dual-plane target (model 1098001) aligned with the light sheet and mapping to pixel locations on the cameras using the method of Soloff et al. (1997)[1].

A single instantaneous vector field can be seen in Figure 2. Vector lengths indicate velocity magnitude, and vector color indicates the freestream velocity.

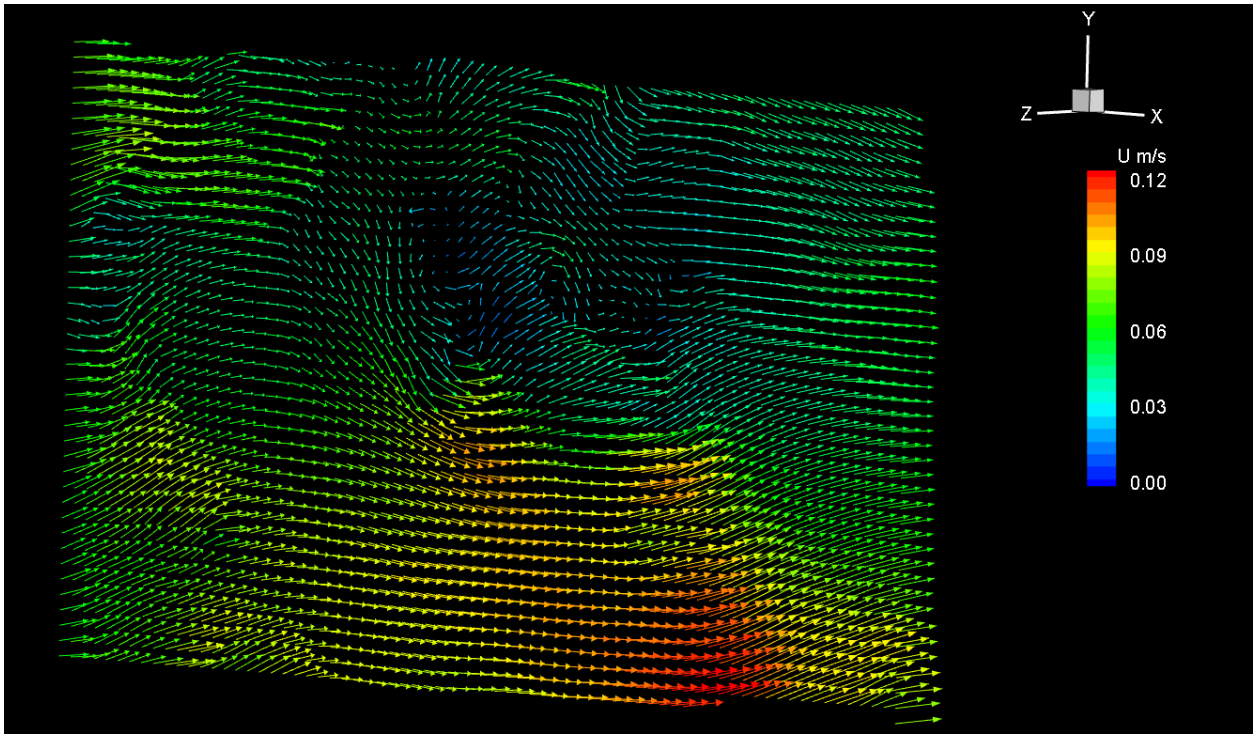

Figure 2
An instantaneous stereoscopic velocity field.

Conclusion

Stereo-PIV measurements were captured downstream of a vertically mounted circular cylinder. 500 velocity fields were captured at a rate of 200 Hz (400 fps).

References

1. Soloff, S.M.; Adrian, R.J.; Liu, Z-C (1997) Distortion compensation for generalized stereoscopic particle image velocimetry, *Measurement Science and Technology*, Volume 8, Number 12.

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