

Development of PIV in Korea

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Abstract

History of PIV development in Korea can be divided in three stages. During the past 25 years, the first 10 years (1984-1994) can be called the initial stage. Korean scholars have learned PIV technique from advanced countries. They conducted PIV or PTV experiments individually. The second stage, 1995-2001, was an expanding period of PIV works in Korea. The number of researcher has been rapidly increased. Especially in this period, Japan and Korea shared ideas in PIV. In 1999, the first Japan-Korea Joint PIV Seminar has launched. This special seminar has held every two years until now. Korea hosted the 6th Asian Visualization Symposium in 2000 at Busan, Korea. This event and the activity of the Visualization Society of Japan stimulated to create a society based on PIV researches in Korea. At last, the Korean Society of Visualization has been established in 2001. The third stage, 2002-present, can be thought as a matured period in Korea. New ideas such as a miniature PIV, X-ray PIV, 3D3C defocusing Micro-PTV, Digital Holographic Micro-PIV has been contributed to the worldwide PIV communities. Thanks to the active contributions of Korean scholars, we hosted the 5th International Symposium on PIV successfully in Busan, 2003. The KSV received a grant from Korean Government for the standardization of PIV. We have suggested International Association for PIV Standardization (IAPS) and organized meetings at Gottingen in 2006 and at Rome in 2007 with representative experts in PIV. Although the idea of IAPS has not continued now, we have to recognize that PIV is the most widely used technique in most of experiments in fluid physics and engineering. The number of members of KSV is continuously increasing in these days. Among them, many of young scholars are challenging to development original and novel ideas for the future PIV technique. In 2010, Korea is hosting the 14th International Symposium on Flow Visualization in Daegu, Korea. After this event, KSV is going ahead to the next decade.

In the presentation, we will present early works related in PIV first then show some pictures taken during international conferences held in Korea. Several key player's works of PIV developed in Korea will be introduced from past to present. Prof. SJ Lee measured velocity field of Red Blood Cell using MRI method in 1984. His in-vivo experiment was not a usual PIV, but another kind of PIV experiment. His laboratory developed 2-frame PTV technique in early 90's and present the result at the 1st International Symposium on PIV. Prof. Lee's group developed X-ray PIV method in late 90's successfully, and measured velocity field in opaque pipe and xylem of leaf. Prof. YH Lee was one of early starter of PIV research in Korea. He has organized the 1st Japan-Korea joint symposium on PIV. Prof. DH Doh developed simultaneous measurement of Temperature and Velocity using LIF/PIV combined method during his Ph.D work at the University of Tokyo in early 90's. After return back to Korea, he developed 3D3C PTV algorithm based on genetic approach. Prof. KC Kim started PIV experiments after working with Prof. RJ Adrian in the middle of 90's. He developed a miniature PIV using super LEDs and CMOS camera with volume illumination in 1999. The system can be used as a velocity measurement probe based on PIV method. Prof. Kim suggested a novel 3D3C Micro-PTV adopting a de-focusing concept using a three-hole aperture and successfully measured time-resolved velocity field and 3D particle positions in a micro-channel in 2005. Despite of simple optical configuration, the accuracy of spatial resolution is excellent than any other 3D3C Micro-PIV method. Prof. JY Yoo developed Nano-PIV based on evanescent wave field using a total internal reflection microscopy. His research group tried to measure Brownian motion of nano-particles very near the solid surface. Prof. SK Kim applied PIV technique to measure nasal flow intensively and the results are used by medical people. In these days, Korean scholars expend the application of PIV technique to Micro/Nano/Bio-Fluid Mechanics. Prof. SJ Lee's group developed digital micro-holographic PIV to measure 3D3C velocity field in micro-channel. The accuracy seems superior compared with other research groups working for holographic -PIV. Prof. HB Kim developed an echo-PIV using ultra-sound technique to measure velocity field in opaque conduit or in-vivo experiment. Prof. HJ Sung conducted PIV experiments to verify the reduction of viscous friction in turbulent boundary layer with micro-bubbles. Some more interesting applications and results obtained by Korean researches will be introduced.