History of PIV development in JAPAN

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The Flow Visualization Society of Japan had been established in 1978. The PIV research and development had been carried out in the Society and its successive society, Visualization Society of Japan (VSJ). In early 1980s, the digital image processing technique had been applied to flow visualization researches. Prof. Yano (1983), Kobe University, proposed the cross-correlation PIV technique as shown in Fig.1. From then, many PIV algorithms had been proposed in Japan, including color-coded PTV, 3D PTV and so on. The fluid engineering researchers were working on the PIV development. In this report, three major epoch making researches of Japanese PIV development history in every decade will be reviewed.

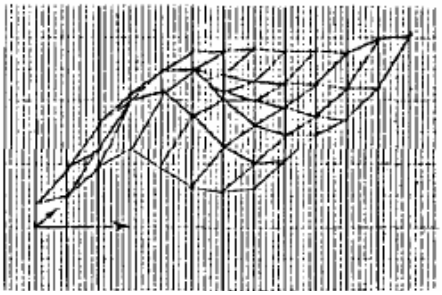

Fig.1 Cross-correlation of binary images (Yano, 1983)

1980s: Near Wall Turbulent Measurement (3D-PTV)

Nishino et al. (1989a, 1989b) developed the 3D-PTV technique to validate the Direct Simulation results of near wall turbulence. They used three cameras and laser disk image recorder. Then, they reconstructed the 3D-3C velocity field with 3D-PTV technique. The velocity data had been statistically averaged to discuss the three-dimensional near wall turbulence. The accuracy of the data was high enough to compare the simulation results. After 20 years, their data are still referred.

1990s: Standard PIV Images

Okamoto, et al. (2000a, 2000b) proposed the Standard PIV Images in 2D/3D. The objective of the Standard Image was to quantitatively compare the PIV algorithms. The correct velocity information was known as the numerical simulation results. Then, the artificial particle images were generated and distributed through internet. (www.piv.jp). The images are extended to measure the 3D+T/3C flow field, i.e., three camera images with time sequence. The Standard PIV images followed the PIV Challenge projects in Goettingen (2001), Busan (2003) and Pasadena (2005).

2000s: Dynamic PIV (Time-resolved PIV, High-speed PIV)

In 2002, the high-speed high-resolution C-MOS camera and high-reputation Nd:YAG laser had been applied to measure the transient flow field (1k x 1k pixel under 2000fps). The PIV now can have the potential to capture the transient without sacrificing the image resolution. The high-speed camera is widely used in many PIV applications, e.g., micro PIV, bio PIV, Digital Holographic PIV, Hybrid PSP/PIV and so on (Okamoto, 2002, 2005). The time-resolved two-dimensional flow fields measurement is now the standard PIV system.

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