EFFICIENT IMAGE ANALYSIS METHOD FOR RIVER FLOW MEASUREMENT USING SPACE-TIME IMAGES

ICHIRO FUJITA [1], HIDEKI WATANABE[2] and RYOTA TSUBAKI [3]

[1] Professor, Department of Architecture and Civil Engineering, Kobe University,
1-1 Rokkodai-cho, Nada-Ku, Kobe, 657-8501, Japan
(Tel/Fax: +81-78-803-6439, e-mail: ifujita@kobe-u.ac.jp)
[2] Graduate student, Graduate School of Science and Technology, Kobe University,
[3] Doctoral student, Graduate School of Science and Technology, Kobe University,
1-1 Rokkodai-cho, Nada-Ku, Kobe, 657-8501, Japan

In the past decade, the non-intrusive image analysis method for surface flow measurements proposed by Fujita and Komura (1994) have been successfully applied for river flow measurements in various field conditions. The method is termed the large-scale particle image velocimetry (LSPIV) by Fujita, Muste and Kruger (1998) as this method is capable to cover the measurement field having a width of one hundred meters or more. However, since LSPIV requires a large storage memory for saving relatively large corrected images and takes time for computation, Fujita and Tsubaki (2005) proposed an alternative practical method, the space-time image velocimetry (STIV), that utilized a space-time image indicating velocity information as its image orientation.

This paper describes a result of STIV in observing streamwise velocity distributions of the Uji River in Kyoto where a number of spur dikes are installed on one side of the river. The surface flow images were videotaped from an observation tower near the river at a height of 40m. One of the measurement results is shown in Fig.1. The surface velocity distribution just in front of a spur dike is successfully measured in the searching lines set parallel to the main flow. The measured velocity distribution is almost identical to the distribution obtained by LSPIV as shown in the figure. Fig.2 is the contour map of the streamwise velocity component. We can observe that the main stream coming towards the upstream spur dike changes its direction to the other side of the spur dikes after passing through this region due to the flow reflection effect of the spur dikes.

According to a sample calculation performed by the authors, STIV is almost ten times faster than LSPIV to obtain the same amount of information, except that LSPIV is a two dimensional measurement method while STIV is a one dimensional measurement method only in the streamwise direction. Therefore, STIV is suitable for the discharge measurement and for constructing a quasi real-time monitoring system where a monitoring camera such as a CCTV camera is available, because this method is safe, cost-effective, and accurate in the actual flood conditions. The advantageous feature of the method is that it can cover the measurement area as large as an order of one hundred meters, 135m by 65m in the present case. It can also be noted that the spatial information presented in this paper is difficult to obtain by the other techniques.

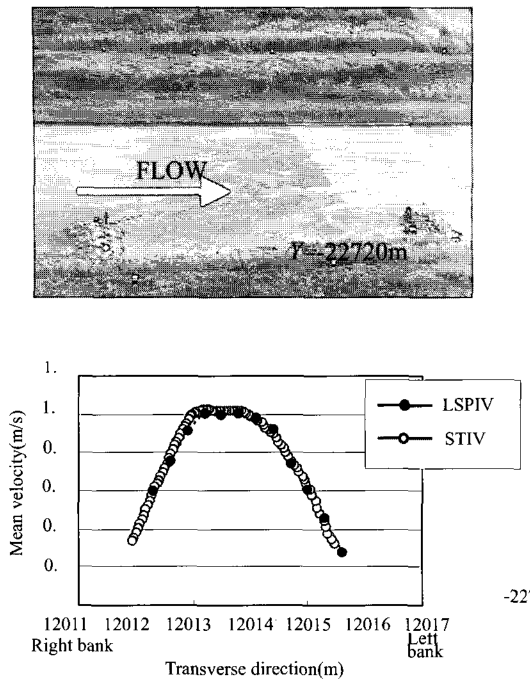

Fig. 1 Measurement location and the comparison of velocity distributions by STIV and LSPIV

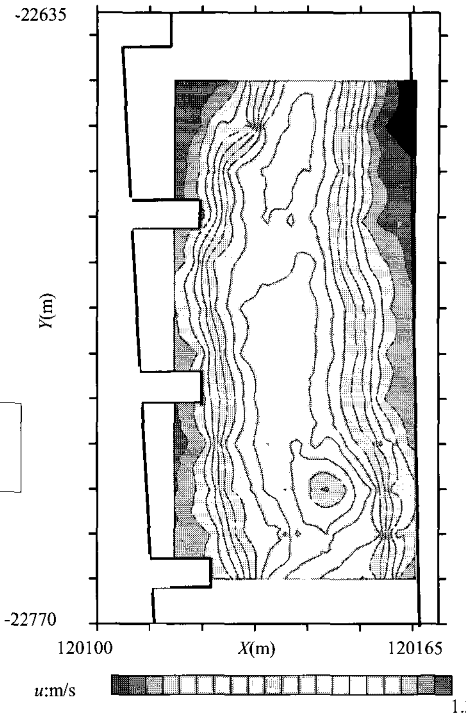

Fig.2 Distribution of downstream velocity component by STIV

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