

A Low-cost In Situ Measurement of Laser Sheet Thickness

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ABSTRACT

A laser sheet is used in several applications for illumination of the tiny particles or objects to be detected for flow measurement or diagnostic purposes. Laser sheet thickness plays an important role in accurate flow measurements such as in particle image velocimetry (PIV). Change in the thickness of the laser sheet may change the mean statistics of the turbulent flow [1]. Measurement of thickness of the laser sheet with enough accuracy is, therefore, an important aspect of successful application of PIV. This paper presents a low-cost technique for accurate in situ measurement of the laser sheet thickness. The technique uses a single image captured with a low-cost CMOS array with a global shutter, for construction of the spatial intensity profile (SIP) of the laser sheet. The full width at half maximum of a Gaussian fit (GF) to the SIP gives a reasonable estimate of the local laser sheet thickness [1]. This technique has been examined with an experiment and gives an accuracy of $5\mu\text{m}$. Moreover, it is easy-to-use and universal to applications where traditional methods of thickness measurement are not feasible. The technique also allows added benefits of checking beam/sheet overlap, sheet parallelism, beam asymmetry and quality (i.e. M^2 value).