

Free-motion measurement of the beam propagation factor by means of a spatial light modulator.

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Abstract content **
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The standard ISO/DIS 11146 describes a procedure to measure the beam propagation factor (M^2) by mechanical scanning of the beam waist region. In contrast to this method, we propose a novel experimental implementation where no moving elements are needed.

Our proposal takes advantage of the features of low-cost programmable liquid crystal spatial light modulators (SLMs). A set of lenses with different focal lengths are sequentially encoded in the SLM. Then, by using a digital sensor at a fixed position, the beam width according to the second order moment of the irradiance is measured for each focal length of the encoded lenses. After fitting the measured data to the theoretical focusing behavior of a real laser beam, the beam propagation factor is obtained.

The use of this kind of modulators introduces some benefits, such as the possibility for high numerical aperture or local beam control of the phase of the lenses which allows for minimizing systematic errors originated by lens aberrations.

The proposed method was successfully validated in the laboratory where a full digital control of the measurement procedure was implemented. The M^2 calculation by this method is very low time-consuming and allows very simple setup. Its application to compact Optics systems is straightforward.

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