A compact zero-angle mirror alignment method based on range-resolved interferometry

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Abstract

A compact zero-angle mirror alignment method based on the autocollimation principle and range-resolved interferometry (RRI) is proposed. This method could be used in many situations where a regular image-based autocollimator is too large or too expensive. The proposed system consists of a fiber coupled interferometer setup with a ultra-compact measurement head which is an FC/PC fiber collimation package with the size of Ø11 mm× 27 mm. In such a system, simple angular search for the maximum return light power from the mirror could in principle be used to achieve perpendicular alignment of the collimator optical axis with the mirror, however, due to multiple reflections between the fiber tip and the mirror, anglular positions with false maxima can occur and are difficult to distinguish from the true maximum position defined by the direct reflection. To identify the interference signals at different ranges, RRI signal processing is used. Using a tip-tilt miror that was controlled to scan in a raster way, the occurance of multiple reflections and their angular distribution was investigated experimentally. To implement the proposed method, the angular position from the direct reflection maximum was identified and its peak center position fitted. Thus the perpendicularity between collimation package axis and the mirror can be set with resolutions in the arcsecond range.