

DEVELOPMENT OF A NOVEL INTERFEROMETRIC DISPLACEMENT MEASUREMENT INSTRUMENT WITH THE FOLDED RESONANT CAVITY

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ABSTRACT: Precision measurement technology is one of the critical points of the development of precision mechanical industry. Because of the rapid development of the precision mechanical industry, the requirements of the measurement parameters are enhanced. The conventional measurement technologies cannot meet these requirements. For this reason, interferometric technology is used in the precision mechanical industry widely. But the conventional interferometric technology cannot demonstrate its characteristics of high precision under the ordinary environment. Therefore, the interferometer cannot yield expected results in the application of precision mechanical industry.

In view of this situation, for the measuring condition of the precision mechanical industry under the fluctuating environments, a Fabry-Perot interferometer with the variable optical structures has been proposed. One of the structures is plane-mirror Fabry-Perot interferometer system utilized in small range, high precision and fine mechanical tolerance. Another structure is folded Fabry-Perot interferometer system which can be performed in large range and mechanical tolerance. By the development of the common path interferometer, the novel arrangement of the optical structure and the optimization of the signal processing model, the measuring range and the resolution of the proposed interferometer can be enhanced. With the aid of this interferometric technology, applications of the common path interferometer for precision mechanical industry can be promoted.

The results and verifications reveal that the interferometric system will be available for precision mechanical industry. From the experimental results, the measuring range is larger than 300 mm, precision about $\pm 0.65\mu\text{m}$ ($\pm 3\sigma$).

Keywords: Fabry-Perot interferometer, folded resonant cavity, common path, signal processing.