

A method for cylindricity evaluation based on minimum zone criterion

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Abstract: Cylindrical components play a significantly important role in the field of micromachining industry and space. Cylindricity error determines the product quality and assembly accuracy. Therefore, the method to evaluate the cylindricity error is quite essential. This paper mainly focuses on the cylindricity evaluation based on the minimum zone criterion in the three-dimensional Cartesian coordinate system. A simple search method is proposed to evaluate cylindricity error by two steps: firstly, coaxial cylinders are projected into X-Y plane which is perpendicular to the least square axis to obtain concentric circles. secondly, a search circle model is employed to gradually approach the minimum zone circle (MZCI) centre of the feature points projected by measured points on the cylindrical surface. The “2+2” mathematical model dominating the minimum zone centre is employed to search the MZCI centre. As a result, the MZCI roundness error equals to the cylindricity error. Simulation experiments and comparison experiments are implemented to ensure the performance of the proposed method. The results demonstrated that the proposed method is effective, reliable and meet the requirements for cylindricity error evaluation.
