Image Multi-Feature Analysis by Principal Component Analysis for Visual Surface Roughness Measurement

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Abstract : Surface roughness is an important index for evaluating surface quality, needs to be accurately measured to ensure the performance of the workpiece. The roughness measurement based on machine vision involves various image features, some of which are redundant. These redundant features affect the accuracy and speed of the visual approach. Previous research used correlation analysis methods to select the appropriate features. However, this feature analysis is independent and cannot fully utilize the information of data. Besides, blindly reducing features lose a lot of useful information, resulting in unreliable results. Therefore, the focus of this paper is on providing a redundant feature removal approach for visual roughness measurement. In this paper, the statistical methods and gray-level co-occurrence matrix(GLCM) are employed to extract the texture features of machined images effectively. Then, the principal component analysis(PCA) is used to fuse all extracted features into a new one, which reduces the feature dimension and maintains the integrity of the original information. Finally, the relationship between new features and roughness is established by the support vector machine(SVM). The experimental results show that the approach can effectively solve multi-feature information redundancy of machined surface images and provides a new idea for the visual evaluation of surface roughness.

Keywords : feature analysis, machine vision, PCA, surface roughness, SVM

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