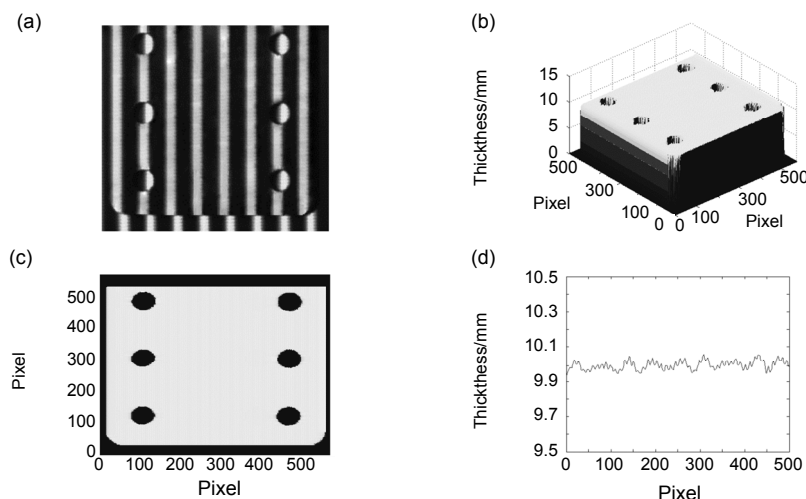


Design of inspection system for exterior quality of steel plate

Liu Zhenqi, Jin Yong*

School of Information and Communication Engineering, North University of China, Taiyuan, Shanxi 030051, China



Test result of steel plate with six holes

Overview: Steel plate, as an indispensable raw material in daily life, has been widely used in various fields. Therefore, it is of great significance to detect the appearance quality of steel plate for improving the production process of steel plate. At present, the mainstream detection methods include eddy current testing, radiographic testing, machine vision detection and so on. These detection methods mainly detect the surface defects of steel plates, and cannot detect the thickness of steel plates while detecting the surface defects of steel plates. In this paper, the surface defects and the thickness of steel plate can be detected at the same time. The 3D reconstruction technique of the grating projection is applied to the steel plate detection, which can reconstruct the three-dimensional contour of the steel plate, and thus achieve the purpose of detecting the surface defect of the steel plate and the thickness of the steel plate at the same time. This paper focuses on the study of the on-line detection of steel plate. In order to meet the speed of on-line detection, wavelet transform profilometry is selected to calculate the phase of the moiré image of the surface of steel plate. Both the wavelet transform profilometry and Fourier transform profilometry are the fastest way to calculate the phase of the moiré image. But the Fourier transform profilometry occupies the advantage on the whole information of the image, and the wavelet transform profilometry pays more attention to the extraction of the local information of the image. At the same time, the noise resistance performance of wavelet transform profilometry is more effective than that of Fourier transform profilometry. Therefore, wavelet transform profilometry is more suitable for calculating the phase of moiré image on steel plate surface. In the aspect of phase unwrapping, branch cutting is chosen as the method of phase unwrapping. Although the quality map guidance algorithm has a high accuracy of phase unwrapping, it is too slow. The phase by point phase unwrapping method has the fastest phase speed, but it is only suitable to unfold the phase without residual error point. Once the phase diagram has a residual error point, the drawing phenomenon will appear in the process of the phase unwrapping, so the error of the reconstructed steel plate will increase sharply. In terms of speed and accuracy, the branch cutting method is suitable for unwrapping the phase calculated from the moiré image of the surface of steel plate. In laboratory environment, the accuracy of steel plate thickness detected by this method can reach 0.08 mm, and the accuracy of surface defect detection can reach 0.2 mm and the detection speed can reach 6 m/s.

Citation: Liu Z Q, Jin Y. Design of inspection system for exterior quality of steel plate[J]. *Opto-Electronic Engineering*, 2018, 45(7): 180032

Supported by Shanxi Scholarship Council of China (2016-084)

* E-mail: jiny@nuc.edu.cn