隧道衬砌裂缝自动检测性能影响因素模型试验研究

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MODEL TEST STUDY OF FACTORS AFFECTING AUTOMATIC DETECTION PERFORMANCE OF CRACKS IN TUNNEL LINING

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摘要 采用混凝土试块并涂抹防火涂料模拟不同工况下的隧道衬砌，设计基于线阵电荷耦合元件(CCD)的移动装置和相应软件进行隧道衬砌裂缝自动检测模型试验，选取图像灰度分布和裂缝检测精度作为评价自动检测性能的定量指标，总结检测距离、光源照度、有效像素和检测速度等因素对自动检测性能的影响规律。模型试验结果表明：图像灰度分布沿裂缝宽度方向呈现波谷特征；检测距离和有效像素对图像灰度分布影响不大，主要影响裂缝检测精度，随检测距离减小、有效像素增大，裂缝检测精度基本呈线性增高；光源照度和检测速度对图像灰度分布和裂缝检测精度都有较大影响，光源照度过高或过低会导致裂缝检测精度降低，随检测速度增大，裂缝检测精度基本呈线性降低。

关键词： 隧道工程   衬砌裂缝   自动检测   线阵CCD   检测性能   模型试验

Abstract： The concrete specimen coated with fireproof paints is used to simulate tunnel lining under different conditions. The mobile equipment based on line-array charge-coupled device(CCD) is designed and corresponding softwares are developed to make the model test on automatic detection of cracks in tunnel lining. Gray distribution of image and accuracy of crack detection are selected as two quantitative indices for assessing automatic detection performance. The influencing law of factors such as detection distance，light source illuminance，effective pixel and detection speed affecting automatic detection performance is summarized. The model test results are as follows：The gray distribution of image along crack width direction shows wave valley features. Detection distance and effective pixel have little influence on the gray distribution of image，but mainly affect the accuracy of crack detection. With the decreasing detection distance and increasing effective pixel，the accuracy of crack detection increases linearly. Light source illuminance and detection speed have great influence on both the gray distribution of image and the accuracy of crack detection. Too high or low light source illuminance can cause a reduction of the accuracy of crack detection. With the increasing detection speed，the accuracy of crack detection decreases linearly.

Keywords： tunnelling engineering   lining crack   automatic detection   line-array CCD   detection performance   model test

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