Control and optimization of UAV measurement parameters for alignment measurement in bridge construction

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Abstract

Alignment measurement is necessary during the process of bridge construction. However, traditional measurement methods consume a lot of time and labor, especially for long-distance measurement. UAV photogrammetry has the advantages of high manoeuvrability, low cost, and independence on labour. The application of UAV to bridge alignment measurement can improve efficiency and promote construction control automation. In this paper, the framework and control parameters of UAV photogrammetry was studied. Experimental study was conducted to investigate the effect of parameters on the measurement accuracy including flying height, angle of bundle, camera position and photo quantity. On this basis, the optimal parameters for bridge alignment photogrammetry are summarized. With the optimized measurement scheme, the coordinate measurement accuracy of each point can reach millimetre level.

Keywords: Bridge construction, alignment measurement, photogrammetry, UAV, Optimal parameters.

1 Introduction

During the cantilever construction of the bridge, it is necessary to measure and control the bridge alignment and stress state to guarantee the error between the actual alignment and the expected state of the structure is within the allowable range to ensure the assembly precision and quality of bridges.

The alignment control of long-span bridges has a large workload, high precision requirements, and high difficulty. At the same time, there are many factors influencing construction control errors. The adaptive control method introduces parameter identification in the construction control to actively carry out the construction status of the structure and can obtain high-quality construction control results [1].

During the process of adaptive construction control, in order to assist feedback calculation and parameter identification, the measurement frequency in each working condition is expected to be as high as possible [2]. The traditional measurement method such as total station or level consumes a lot of time and labours. It is urgent to use a more efficient measurement method independent on manual work.

In recent years, photogrammetry and UAV develop rapidly and are gradually applied to all aspects of engineering applications, such as bridge detection,

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