

High-speed 3-Dimensional Digital Image Correlation System and Its Application to the Measurement of High Speed Projectile

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Summary

In order to measure the attitude parameters of the projectile, a high-speed 3-dimensional digital image correlation (H3D-DIC) system is designed and constructed. In the H3D-DIC system, two high-speed cameras are used to capture the images of the projectile from two different directions and the 3-dimensional coordinates of the markers painted on projectile are obtained by processing the images using stereovision techniques. Because of the difference on the resolution of the two cameras, the images captured are with different magnification. Therefore, a new correlation program, in which the parameter of pixel size is also included in the correlation schedule, is designed to realize the matching of the images with different magnification.

An experiment to measure the attitude of a shot arrow is performed to verify the developed H3D-DIC system. Before experiment, the imaging parameters for the two high-speed cameras are firstly calibrated. Then a specially designed opto-electrical trigger is used to monitor the emergence of the arrow and then to start the two high-speed digital cameras simultaneously when shooting. After that, the digital images are processed using a specially designed 3D-DIC program, and the high-speed 3D coordinates of the markers painted on the arrow is obtained. The attitude parameters of the arrow are then analyzed through the measured high-speed 3D coordinates of the markers.

Key words: 3-dimensional digital image correlation, high-speed, projectile

