



Measurement methods and accuracy analysis of Chang'E-5 Panoramic Camera installation parameters

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Abstract: Chang'E-5 (CE-5) is a lunar probe for the third phase of China Lunar Exploration Project (CLEP), whose main scientific objectives are to implement lunar surface sampling and to return the samples back to the Earth. To achieve these goals, investigation of lunar surface topography and geological structure within sampling area seems to be extremely important. The Panoramic Camera (PCAM) is one of the payloads mounted on CE-5 lander. It consists of two optical systems which installed on a camera rotating platform. Optical images of sampling area can be obtained by PCAM in the form of a two-dimensional image and a stereo images pair can be formed by left and right PCAM images. Then lunar terrain can be reconstructed based on photogrammetry.

Installation parameters of PCAM with respect to CE-5 lander are critical for the calculation of exterior orientation elements (EO) of PCAM images, which is used for lunar terrain reconstruction. In this paper, types of PCAM installation parameters and coordinate systems involved are defined. Measurement methods combining camera images and optical coordinate observations are studied for this work. Then research contents such as observation program and specific solution methods of installation parameters are introduced. Parametric solution accuracy is analyzed according to observations obtained by PCAM scientifically validated experiment, which is used to test the authenticity of PCAM detection process, ground data processing methods, product quality and so on. Analysis results show that the accuracy of the installation parameters affects the positional accuracy of corresponding image points of PCAM stereo images within 1 pixel. So the measurement methods and parameter accuracy studied in this paper meet the needs of engineering and scientific applications.

Keywords: Chang'E-5 Mission; Panoramic Camera; Installation Parameters; Total Station; Coordinate Conversion