Paper ID: 26016
poster

SPACE DEBRIS SYMPOSIUM (A6)
Poster Session (P)

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THE EFFECT OF SPECULAR REFLECTANCE ON SPACE TARGET DETECTING

Abstract

One of the challenges facing computer vision systems used in space target detecting is the presence of specular reflection. The effect due to specular reflection may lead to incorrect measurements and loss of data in the case of sensor saturation. But specular reflection is also useful in some conditions. A mathematical model of space target illumination characteristics is established based on the basic theory of radiation by considering geometry, background, and material characteristics of the space target. Using the model, the spatial distribution of scattering light intensity from the space target is calculated with the modeling and blanking technique of target when being illuminated by the sun. The relations of specular reflectance with the position, geometry, materials and other attributes of the space target are analyzed. Furthermore, the effect of specular reflectance on space target detecting is discussed. A method of characteristic simulation of space target is presented. According to the structure and data of three typical satellites, the 3D model of space target with distinct sizes and shapes are constructed by 3DMAX. The spatial distribution of scattering light intensity of solar panel, main body and whole about the three space targets are calculated by combining with the orbit of targets, the position of sun and location of detectors. Then the curves of distribution of scattering light intensity are plotted, which display the specular reflectance intensity and frequency of occurrence comparing with diffuse reflectance. The simulation result indicates that polyhedral structure, mirror surface, or solar panel is easy to cause specular reflection. It also shows the effect of specular reflectance is helpful for detecting the space target in the condition of low contrast ratio or low illumination.