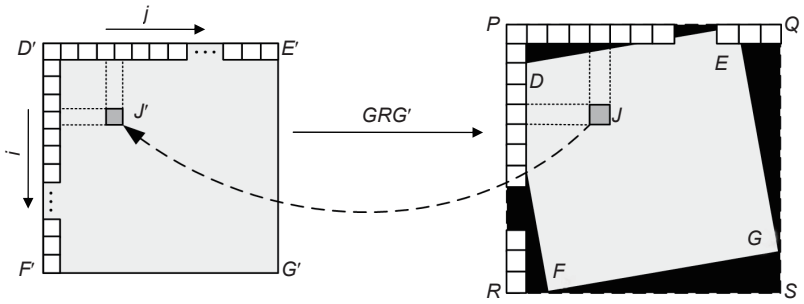
Elimination method of image rotation for geostationary radiometer and its verification method

Wang Meizhu[1,2,3], Huang Xiaoxian[1,2,3], Feng Qi[1,2,3*]

[1]Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai 200083, China;
[2]CAS Key Laboratory of Infrared System Detection and Imaging Technology, Shanghai Institute of Technical Physics, Shanghai 200083, China;
[3]University of Chinese Academy of Sciences, Beijing 100049, China



Sketch map of image outline for image rotation elimination unfinished and rotation elimination finished

Overview: China has 18000 km coastline and the oceans have a vital impact on our climate, agriculture and military. At present, the observation of the oceans in our country is still in the polar orbit observation stage with a revisit cycle of 1～2 days. However, tides, currents, storm surges, oil spills and military activities often change greatly in one day. Therefore, the development of Geostationary Ocean Radiometer is imperative. The geostationary ocean radiometer can perform high-frequency observations of a specific area of ocean. However, due to the influence of the optical system, the observing field is small and additional scanning equipment is needed to expand the observation field. Two-dimensional pointing mirror with plane detector and staring imaging is a better way. Two-dimensional pointing mirror has small size, light weight, and can rotate flexibly. However, the rotation of two-dimensional pointing mirror about its tilt and azimuth axes introduces errors in imaging system, including non-linear errors and image rotation errors.

The purpose of this paper is to eliminate the image rotation errors introduced by two-dimensional pointing mirrors. The image rotation elimination method has also been proposed before, including optical method and image processing method. They are often used in the image rotation of polar orbiting satellites, aimed at linear array detectors and have obvious effects of image rotation elimination, but no quantitative verification method is given. The proposed image rotation elimination method is aimed at the image rotation errors introduced by the two-dimensional pointing plane imaging optical system of geostationary orbit. In this paper, we analyze the image rotation errors, propose the elimination method according to the correspondence between objects and images, give the image rotation elimination formula, and use the bilinear interpolation method to get the refined image. At the same time, we extract the SIFT feature points of the test images, give the corresponding quantitative verification method based on the degree of rotation between feature points of adjacent images. According to images taken by the Geostationary Ocean Radiometer model machine, it is proved that the proposed rotation elimination method can reduce 39% of image rotation errors. This indicates that the algorithm greatly improve the geographical accuracy of two-dimensional directional imaging and improve the accuracy of remote sensing instruments. Therefore, the work lay a good foundation for image processing in two-dimensional pointing plane imaging system.

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* E-mail: fengqi168@vip.sina.com