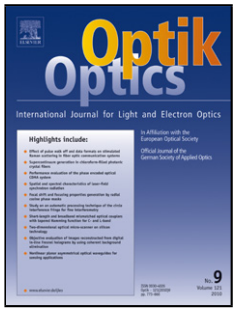

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Ellipticity Pivot Star Method for Autonomous Star Identification

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Abstract

A new fast algorithm for autonomous star identification in the general lost-in-space case is developed based on optimized catalog. The proposed method takes advantage of singular value decomposition method and the accuracy angular separation information. The central idea is that a unique pattern is created for each of guide star so that the pattern recognition is simple and straightforward and the index entry reaches minimum. The unique pattern is comprised of ellipticity and angular separations between pivot star and adjacent stars. The method for selecting adjacent stars of pivot star and how to rank them is presented. Three series of simulations each of which included more than ten thousand star tracker orientations were performed by dividing the entire celestial sphere into small regions. The results support the validity of the proposed method that achieves higher identification rate with 99.999%.

Keywords: star identification, star catalog, singular value decomposition, star tracker, attitude determination

1. Introduction

Star tracker is intentionally invented for attitude determination in both orbiting and interplanetary spacecraft by sensing constellation. It has been one of the most critical components for spacecraft's guidance, navigation and control. Conventionally, the process of attitude determination consists of these main steps: star centroiding, feature extraction, star identification and attitude determination. Star identification is the key point of the star tracker, and many individuals have developed algorithms for star identification[1]. Most of the algorithms identify each of the stars in the image, and then convert the locations of the identified stars to unit vectors for attitude estimation of satellites. The crux of star identification is to create features that independent on

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