SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
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DEVELOPMENT OF STAR TRACKER DESIGN AND TEST SOFTWARE: INNOVATION AND OPTIMIZATION

Abstract

Utilization of star trackers as an aiding navigation system has augmented noticeably in the past decade. The complex nature of space missions requires that the star tracker design become more elegant. To achieve this purpose, educating student teams in order to participate in the design and optimizing manufacture fields of star trackers is an important task. The objective of this paper is to introduce the specially developed software for design and test the processing chain of a star tracker, Star Tracker Design and Test (STDT). This software has been used and evaluated in the development process of Nasir I student star tracker which is built in laboratory environment in K.N.Toosi University of technology, Aerospace faculty in June 2012. STDT has the ability of executing each module of processing chain individually or combine modules in a processing loop to perform overall tests. The software is also capable of adapting new self developed algorithms for each module until their correlation is conserved. The modules forming this software are as followed: - Sky simulator module: In this section, user can choose between available, preprocessed star catalogues and specify the camera parameters required for simulating the sky. - The next module is image processing algorithm. In this section the centroiding algorithm can be selected among available algorithms. The input can be generated using the sky simulator or manually selected from a pre-taken night sky image. The output is the star magnitudes and centroids. The errors regarding the centroiding algorithm are applicable. - The third module is the star pattern recognition algorithm which is divided in two major parts. The first part produces the required database while in the second part, the performing pattern recognition algorithm can be selected. The input of pattern recognition module is the centroids of the processed image and the output is the identified star indexes. - The last module contains the attitude determination algorithm. This section can define the transfer matrix between the body and inertial vectors of the stars. The software provides the possibility of Monte-Carlo analysis for each module individually or in a processing loop. The test environment can be utilized for parameter effect study on update frequency, true recognition percentage or etc. or determining the feasibility of newly developed methods. It is perceptible that STDT software can facilitates the process of star tracker development by obviating the programming bugs and realizing innovative ideas.