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DEVELOPMENT OF A VISUAL NAVIGATION SYSTEM FOR THE SATELLITE DYNAMIC SIMULATOR LUVEX

Abstract

This paper aims to present a systematic study made in the development of an absolute visual navigation system for the satellite dynamic simulator LuVex. LuVex is a robot vehicle developed for testing GNC algorithms corresponding to rendezvous and formation flying experiments. Its working environment is a simplified 2D implementation of the regular 3D scenario encountered in space and the setup consists of a dark flat ceiling with Light Emitting Diodes (LED's) representing stars, mounted above a frictionless glass table test bed of size 2x3 m. Air cushions underneath the vehicle enable it to float on the table in a 3 degrees of freedom environment i.e. two translations and one rotation. The visual navigation system is based on star tracking technology and uses a camera that produces regular sequences of images. These images are processed online for feature extraction, centroiding, establishing a correspondence between the stars in the image to that of ceiling, followed by obtaining a navigation solution for LuVex. Offline verification was done in Matlab prior to writing on-board code using C language. With appropriate sensor fusion and observation techniques, the proposed navigation system is intended to be used in association with other on-board sensors for continuous state estimation of LuVex. Simplified algorithms are chosen to suit the application at every stage both for faster computation and code optimization. The methodology presented here can well be adopted to develop navigation applications operating under similar conditions.