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AUTONOMOUS NAVIGATION SYSTEM BY OPTICAL INFORMATION FOR PLANET'S SURFACE LANDING

Abstract

Precise landing on the planet's surface has become one of the main trends for future planetary exploration missions. As the traditional methods (such as inertial navigation system) excessively depending on initial values and having integral error accumulation, they have been unable to meet the accuracy requirement of landing mission. It is necessary to develop new types of navigation method based on visual measurement. In this paper, the relevant navigation methods using visual measurement for landing on the planet's surface is studied. The main content of this paper follows: Firstly, Harris corner and SIFT feature descriptors are studied, which are classical algorithms for feature extraction and matching. Then a highly efficient SIFT feature extraction and matching algorithm will be established, which will be used to verify feature matching accuracy through simulation analysis. Secondly, the navigation method based on mapping landmarks is studied. In order to fuse the IMU measurement with the visual measurement matched by descent image features and mapped landmark in the powered descent phase, a filter was designed to suppress the influence of IMU bias and system noise. Finally, the method of building minimum-fuel powered descent trajectory for planet pinpoit landing is studied. Minimum-fuel trajectory in Mars' is built and taken into the filter to calculate estimated trajectory. In order to verify the accuracy of visual autonomous navigation, Monte Carlo simulation for estimated trajectory's position error, velocity error and attitude error is done.