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LOCAL AREA NAVIGATION SYSTEM USING PSEUDOLITE TRANSCEIVER AND TWO-WAY MEASURING TECHNIQUE

Abstract

Pseudolite based local area navigation system can be a good navigator on exploring Lunar or Mars surface. Because pseudolite is based on the radiometric technique, it is free for the bias- or drift-form errors and its accuracy is very good for other navigation system. The research about this topic was done by LeMaster of Stanford Univ. in 2002. Our system is similar as LeMaster's SCPA system, but has several differences, merits and defects for main algorithms and hardware comparing to LeMaster's. This paper proposes pseudolite based local area navigation system which can be self-deployed without any helps of humans or robots. That is a "Self Operated Pseudolite Array System (SOPAS)" using transceiver form pseudolite and two-way measuring techniques. Pseudolite is a GPS-like signal transmitter, so we can make local area position system using pseudolites. To deploy pseudolite based positioning system, however, we must settle several difficulties. The first difficulty is interference with other pseudolites. The second thing is to estimate locations of pseudolites and the third thing is to synchronize clock of pseudolites. Without solutions for those difficulties, pseudolite based positioning system can't be deployed. The goal of this paper is to settle those problems. The SOPAS was to use an array of two-way pseudolites based on the transceiver form. To minimize interference with other pseudolites, we proposed a distributed pulsing technique. To estimate the locations of pseudolites, we proposed a self-localization method using two-way distance measuring technique. To synchronize the clock of pseudolites and, we proposed a self-synchronization method using a two-way clock error measuring technique. These three techniques are the key algorithms on the SOPAS. In the simulation and real test, we could see the feasibility of the SOPAS and the positioning accuracy was about several cm. So this navigation system and techniques can give good navigation solution on exploring Lunar or Mars surface, and also extend the range of application of the pseudolites.