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THE VISIBILITY PERFORMANCE OF COMPASS/GPS IN NEAR-EARTH SPACE

Abstract

COMPASS is the satellite navigation system of China and would be completed in 2020. 15 satellites had been launched by the end of 2012. Although the current COMPASS can't supply the service for global users, many researches have discussed the coverage or visibility performance for global users with Global Navigation Satellites System (GNSS) integrated with COMPASS. Number of Visible Satellite (NVS) is always selected as the performance index.

However, the previous researches on visibility have the following defaults. The users are often supposed in the surface of the Earth or in Low Earth Orbit (LEO). The navigation satellites constellations are always supposed to have the whole satellites. And the worse situation is the simulated COMPASS constellation in research generally corresponds to the original plan while the real constellation is different. For example, 6 satellites of the current COMPASS run in Inclined GeoSynchronous Orbits (IGSO) while only 3 IGSO satellites was scheduled to launch according to the original plan.

It is obviously that the satellites visibility should be discussed with the real current constellation for more users. The users are not only in the surface of the Earth or in LEO, but also running in near-Earth Space such as Middle Earth Orbit (MEO).

So, the current COMPASS integrated with Global Positioning System (GPS) is discussed here. The main research work is followed:

Firstly, the current 15 COMPASS satellites are constructed according to the real information from website. And so does for GPS. The real integrated constellation consisting of COMPASS and GPS is finished.

Secondly, to value the visibility performance more reasonably, the new performance indexes are proposed according to NVS. Based on distribution of NVS in fixed place and fixed time, Total Invisible Time Percent (TVTP) and Maximum Invisible Period (MIP) are introduced to estimate the worst visibility situation in the limited area during the available time.

Finally, the users are supposed to be around near-Earth Space. The altitude of users is from 400km to 36000km.

Simulation shows that the visibility decreases generally as the latitude increases while some area in Geostationary Earth Orbit (GEO) equator could receive the satellites navigation signal for 24 hours because of the 5 GEO COMPASS satellites. Current COMPASS also could increase the visibility in pole

area where single GPS visibility is always poor. COMPASS integrated with GPS could supply better visibility than single COMPASS or GPS does.

Keyword: current COMPASS, visibility performance, GPS