Paper ID: 39591
oral
student

ASTRODYNAMICS SYMPOSIUM (C1)
Guidance, Navigation & Control (1) (3)

Author: Ms. Flavia Causa
University of Naples "Federico II", Italy

Dr. Alfredo Renga
University of Naples "Federico II", Italy
Prof. Michele Grassi
University of Naples "Federico II", Italy

IONOSPHERIC PATH DELAY MODEL FOR REAL TIME CDGPS-BASED BASELINE ESTIMATION FOR LEO SATELLITES

Abstract

Precise baseline estimation with Carrier Phase Differential GPS (CDGPS) requires the compensation and estimation of Integer Ambiguities and Ionospheric path delays, which become not negligible when the distance between the platforms increases. In formation flying applications involving low Earth orbit satellites with large baseline (¿100 km) double difference ionospheric path delays can be higher than several carrier wavelengths. This represents a major problem for the correct estimation of the integer ambiguities that affects the baseline estimation accuracy. Thus, ionospheric delay estimation plays a fundamental role in these applications. On-board baseline estimation filters require an ionosphere model that is both precise and fast. The ionosphere estimators shall fit ionosphere distribution with a precise but simple model that can run in real time. This model must include a mapping function and a Vertical Total Electron Content (VTEC) function. This paper aims at identifying the best model in predicting ionospheric delays that can be used in a real time filter in order to improve the baseline estimation accuracy and the integer ambiguities resolution. For this purpose thick shell and thin shell mapping functions are described and compared in this paper using GRACE data in different ionospheric conditions. Further investigations are then performed by introducing a bilinear expansion for the VTEC that should guarantee a better prediction in reproducing ionosphere horizontal gradients. This model assumes a linear dependency of the VTEC from the difference in latitude and longitude between the ionosphere pierce point (IPP) and the receiver. The introduction of the model improves the accuracy of the ionospheric delay prediction with an increasing correlation coefficient and a reduced RMS error.