IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Advances in Space-based Navigation Systems, Services, and Applications (6)

Author: Mr. Alexei Harvard
California Institute of Technology, United States, alexh@caltech.edu

Dr. Vincenzo Capuano
California Institute of Technology, United States, vcapuano@caltech.edu
Prof. Soon-Jo Chung
California Institute of Technology, United States, sjchung@caltech.edu

CDGNSS INTEGER AMBIGUITY RECOVERY THROUGH CO-OBSERVATION

Abstract

Existing integer ambiguity algorithms such as MLAMBDA rely on linearization and an assumption of normal noise. However when combining multiple sensor measurements, the resulting posterior probability distributions from noise highly deviate from Gaussian distributions. Further, due to the discrete nature of ambiguity selection, most algorithms that determine whether the ambiguity was correctly recovered rely on an ad-hoc comparison between the resulting errors of the best and second-best solutions. We demonstrate that this is an unreliable metric, particularly when there is a high Geometric Dilution of Precision (GDOP) and the existence of multipath.

In this paper we analyze the noise distributions that result from fusing vision and CDGNSS and propose an algorithm which gives probabilistic guarantees when recovering double differenced ambiguities and a meaningful metric for determining when the ambiguity recovery was successful. This has applications in degraded signal environments, such as High Earth Orbits (HEO) and terrestrial environments where few satellites are visible. Experimental validation is done in Caltech's CAST arena, a GNSS degraded environment with high GDOP due to low satellite visibility.