Geophysical Research Abstracts
Vol. 17, EGU2015-14796, 2015
EGU General Assembly 2015

GNSS Carrier Phase Integer Ambiguity Resolution with Camera and Satellite images

Patrick Henkel
Institute for Communication and Navigation, Technische Universität München, Munich, Germany

Ambiguity Resolution is the key to high precision position and attitude determination with GNSS. However, ambiguity resolution of kinematic receivers becomes challenging in environments with substantial multipath, limited satellite availability and erroneous cycle slip corrections. There is a need for other sensors, e.g. inertial sensors that allow an independent prediction of the position. The change of the predicted position over time can then be used for cycle slip detection and correction.
In this paper, we provide a method to improve the initial ambiguity resolution for RTK and PPP with vision-based position information. Camera images are correlated with geo-referenced aerial/ satellite images to obtain an independent absolute position information. This absolute position information is then coupled with the GNSS and INS measurements in an extended Kalman filter to estimate the position, velocity, acceleration, attitude, angular rates, code multipath and biases of the accelerometers and gyroscopes. The camera and satellite images are matched based on some characteristic image points (e.g. corners of street markers).
We extract these characteristic image points from the camera images by performing the following steps: An inverse mapping (homogenous projection) is applied to transform the camera images from the driver's perspective to bird view. Subsequently, we detect the street markers by performing (a) a color transformation and reduction with adaptive brightness correction to focus on relevant features, (b) a subsequent morphological operation to enhance the structure recognition, (c) an edge and corner detection to extract feature points, and (d) a point matching of the corner points with a template to recognize the street markers.
We verified the proposed method with two low-cost u-blox LEA 6T GPS receivers, the MPU9150 from Invensense, the ASCOS RTK corrections and a PointGrey camera. The results show very precise and seamless position and attitude estimates in an urban environment with substantial multipath.