Precise GNSS Positioning for Mass-Market Applications

Yang Gao (Canada)

Key words: GNSS/GPS; GNSS/GPS; low-cost GNSS; RTK; PPP; mass-market applications

SUMMARY

Mass-market applications, ranging from self-driving cars, unmanned aerial vehicles to handheld smartphones, are increasingly demanding high-precision from GNSS. This expectation is driven by the increasing availability of carrier phase measurements from very low-cost GNSS sensors of small form factor (chipsets or modules) that widely used in mass-market applications. Google has made raw GNSS measurements including carrier phase available from a phone or tablet computer. Broadcom has also recently announced to launch a mass-market GPS chip that uses L1 and L5 signals to pinpoint a device's accuracy to within 30 centimeters. Although the carrier phase measurements, particularly in challenging environments, are still subject to further improvement and verification by user applications, their potential to support precise positioning is just a matter of time.

Precise GNSS positioning using low-cost GNSS sensors faces some significant challenges. Current high-precision GNSS techniques, either based on real-time kinematic (RTK) or precise point positioning (PPP) techniques, are based on high-end GNSS receivers and usually targeted for applications such as geodetic surveys, airborne mapping, atmosphere remote sensing, precision agriculture, marine positioning. They also depend on high-frequency real-time corrections for error mitigation which is sensitive to correction outages. Different from the conventional high-precision GNSS applications, only low-cost GNSS sensors are available for mass-market applications and precise position must also be available whenever needed. In other words, instant obtainability of precise position solutions is required and long ambiguity convergence and fixing time will not be acceptable in the field. High reliability requirement in mass-market applications presents further challenges to precise positioning with low-cost GNSS sensors.

This presentation will address the abovementioned challenges. They include discussions of new

strategies and techniques to achieve instantly obtainable precise positioning to support different mass-market applications, to reduce system cost and complexity in correction services, and to assure the reliability of obtained GNSS solutions in challenging environments. Numerical results from field tests conducted in operational environments will be provided to demonstrate new precise positioning techniques developed for mass-market applications.