

# REAL-TIME PRECISE POSITION ESTIMATION OF GEOSTATIONARY EARTH ORBIT SATELLITES USING GROUND BEACONS

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## Abstract

This paper presents a method for precise estimation of the position of Geostationary Earth Orbit (GEO) satellite, using radio-waves, from at least four beacons mounted on the ground. The locations of these beacons are known and fixed with respect to an observer on the Earth. GPS-based instantaneous position determination has been studied in the literature extensively since early 1980's, and has been used on-board Low-Earth satellites. However, for Geostationary Earth Orbits (GEO) the visibility of Global Positioning System (GPS) satellites is limited to a small conical annulus formed by the main beam of the GPS satellite on the far side of the GPS-Earth cone. So at any measurement epoch there may not be four GPS satellites available to form four independent equations to solve explicitly for the required four unknowns. GEO being the most prominent of orbits with diverse applications, so we propose in this paper a new concept of use of ground based beacons for real time precise orbit determination of GEO satellites.

The technique presented in this paper is inverse Global Navigation by Satellite Systems (GNSS). The usual case is GNSS/GPS signal from space is used to estimate the position of the satellite/object fitted with GNSS receiver. In the present scheme GEO satellite is fitted with a receiver and beacons are mounted at the ground in India or globally. The present scenario is thus different but slightly. This interesting concept will be useful for position estimation of GEO satellites equipped with a receiver to get measurements or observables from beacons. The simulation results have shown that it is possible to find the precise position of the Earth orbit satellites at GEO altitude.