GPS DIFFERENTIAL POSITIONING USING LEAST SQUARES

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Abstract

The Global Positioning System (GPS) is an all weather, worldwide, continuous coverage, satellite based navigation system. GPS satellites transmit signals that allow one to determine, with great accuracy, the location of GPS receivers. In GPS a typical technique for estimating the position of a moving (roving) object is differential positioning, where two receivers are used — one receiver is stationary and its exact position is known, the other is roving and its position is to be estimated. In this talk we describe the physical situation and derive the mathematical model. We then present a recursive least squares approach for position estimation based on the difference of the measurements at the stationary and roving receivers. We take full account of the structure of the problem to make our algorithm efficient, and use orthogonal transformations to ensure numerical reliability of the algorithm. Simulation results will be presented to demonstrate the performance of the algorithm. A comparison with the van Graas and Lee [1] "complementary Kalman filter" positioning algorithm will be given.

References

[1] F. van Graas and S.-W. Lee. High-Accuracy Differential Positioning for Satellite-Based Systems Without Using Code-Phase Measurements, *Navigation, Journal of The Institute of Navigation*, Vol 42, Winter 1995, pp. 605–618.

[2] X.-W. Chang and C. C. Paige. An efficient algorithm for GPS positioning. *Submitted November 2001 to the SIAM Journal on Scientific Computing.*

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