

Provence, R.S., “Navigation Filters for Use in the Global Positioning System”

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This dissertation explores the nonlinear noise properties of multipath in the Global Positioning System (GPS) while presenting several new approaches to pseudorange only navigation and pseudorange rational model estimation. Noise in GPS is complex, but typically poorly modeled in classical approaches. In this dissertation, real-world multipath test cases are presented and analyzed along with the presentation of new navigation filters. The first navigation technique involves optimal linear modeling which determines the system equations at the receiver’s operating point in space; as opposed to traditional approaches that linearize about equilibrium points. The second approach builds upon the optimal linear model method and adds measurement differencing to achieve improved accuracy. Finally, rational model estimation theory is applied to pseudorange measurements to identify the nonlinear pseudorange model structure. A single pseudorange model is structured such that it is dependent upon additional pseudorange measurements from other observed GPS satellites.