

# Abstract

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A Novel solution to Integrating GPS and INS Systems

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With the view of keeping pace with expected performance levels, modern location based tracking systems employ a combination of the Global Positioning System (GPS) and Inertial Navigation Systems (INS). An ongoing problem with the traditional approach, which utilizes linear control methods, is the inherent loss of optimality of the obtained solution. This study is an investigation of an approach to integrate both systems utilizing a non-linear Markov Chain Monte Carlo simulation, specifically a Particle Filter, which incorporates satellite geometry data in obtaining positional estimates. The specific filter was built at the software level using a combination of Matlab and the Java programming language and performance tested with the aid of concurrent real-time estimates from both GPS and INS systems while (a) stationary, and (b) in motion. This research illustrates quantitatively, in light of the various equipment related costs, that there are slight but noteworthy improvements over existing techniques in terms of the observed cost for a given performance, specifically in solutions ranging in cost from inexpensive (coarse solutions) to mildly expensive (non mission critical).

Keywords: Chad Toshiro Andrade; GPS and INS integration; Particle Filters; Kalman Filters; Rao Blackwellization.