ASEN 5070-Stastistical Orbit Determination-Final Project Report

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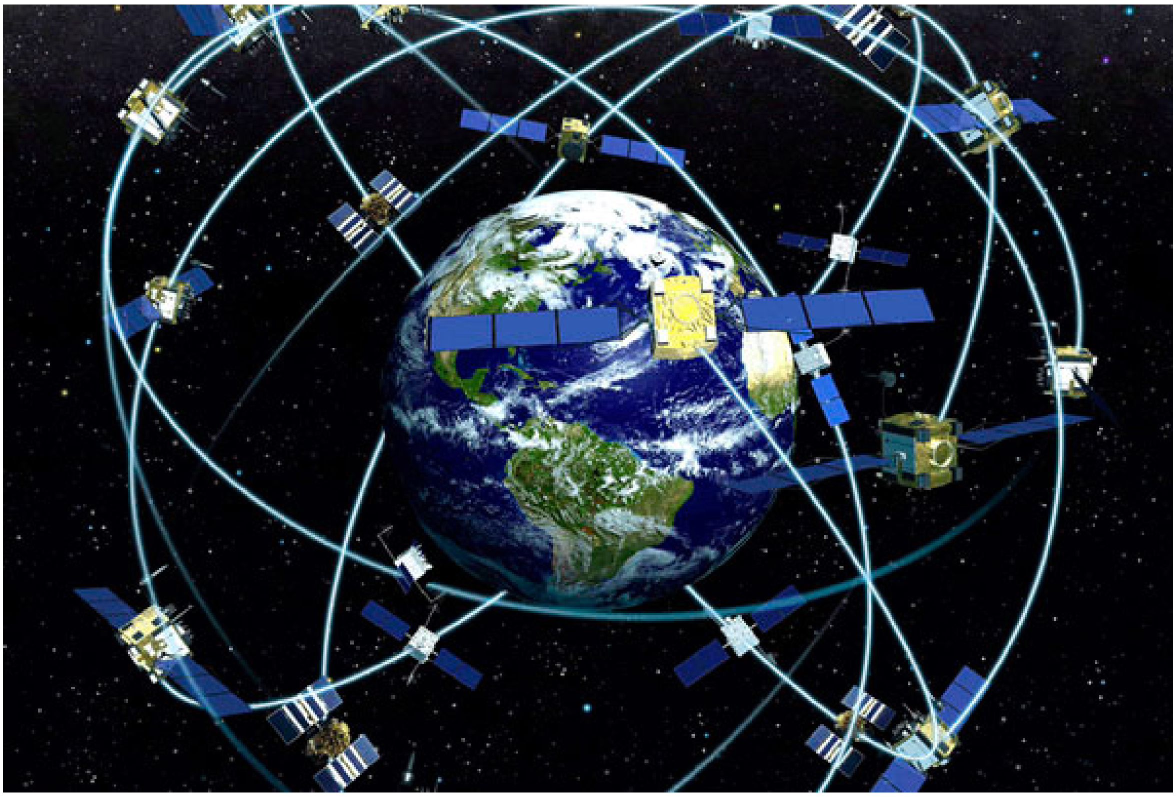 [1]

1 Introduction

This report summarizes an investigation of various methods of statistical orbit determination, as outlined in ASEN 5070. All programming was performed in Matlab, using a combination of built in functions, self-defined functions, and ones created in collaboration with others. I will examine the results and implications of various filter methodologies including:

- Batch Processor
- Conventional Kalman (Sequential) Filter
- Extended Kalman Filter
- State Noise Compensation
- Alternative Methods for Determining P, the Covariance Matrix

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2 Background

2.1 Orbit Determination Process

The orbit determination process is, at the fundamental level, one which determines a celestial body's motion relative to another. Typically, this process is used to determine the motion of Earth-launched satellites relative to Earth. Though the problem can and is often applied to a variety of systems, but this paper will concern itself with Earth-centered satellites and their dynamical states.

The state of a satellite is "a set of parameters required to predict future motion of the system"[2]. These parameters include the position and velocity vectors of the satellite, and often includes other information relating to the dynamical model. Other information can include atmospheric drag, solar wind, gravity terms, tracking station information, or other system dynamics. Fundamentally, anything can be included in the state that the operator would wish to track and model.

The process of determining a satellite state at a given Epoch involves convolving information about its present and past state, in a mathematically optimized manner. Present state information comes from both physical observations of the system, as well as from a dynamical system model. Observations often comes from range, range-rate, azimuth, elevation, angel, and other physically observable quantities, provided by tracking ground station or other celestial bodies. The dynamical model is a purely mathematical approximation of the satellite's state in time. Information about the satellite's past state (*a-priori* information) comes from the navigator's historical data.

3 My system

References

[1] A. Name. A thing. `somesite.orgnet`.

[2] B. Tapley, B. Schutz, and G. Born. *Statistical Orbit Determination.* Elsevier Acad. Press, 2004.