Senior Design Project in Electrical & Computer Engineering

LORAN Remote Control Using Kalman Filtering

Cadet 1/c Brendan M. Evans Advisor: LT Suzanne Landry Sponsor: USCG LORAN Support Unit

Project Goal

The goal of this project is to design a LORAN- C timing control algorithm using a Kalman Filter and a Linear Quadratic Regulator (LQR) design, then analyze its performance against the current algorithm used by the LORAN Consolidated Control System (LCCS).

Current LORAN-C control and timing equipment

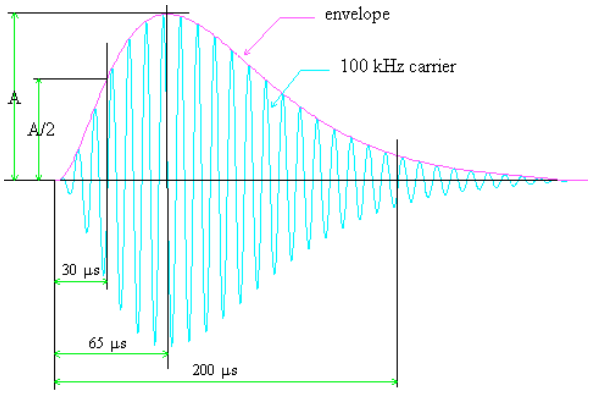
Project Plan

To produce a Kalman filter/LQR algorithm in Matlab that outperforms the current Linear Least Squares algorithm. As this project is a continuation from last year, our goal is to improve the design created last year.

Status

The algorithm designed last year did not perform as wells the current LCCS algorithm. Modification to both the system model and the Kalman filter is required to achieve optimal results and determine if he algorithm is a viable alternative for implementation.

LORAN-C Pulse Characteristics



Project Background

Currently, the need for timing adjustments for LORAN- C stations in North America is determined by the LORAN Consolidated Control System (LCCS), which uses a Linear Least Squares Algorithm.

A Kalman Filter Algorithm was proposed by researchers at Naval Post Graduate School, Monterey, California to perform the same function as the Linear Least Squares Algorithm. The algorithm has not yet been fully developed or evaluated to determine its performance.

The Kalman Filter algorithm estimates future time difference errors (TDE) based on past system information, taking into account measurement and process noise. The time adjustments, or Local Phase Adjustments (LPA), for the Kalman Filter are calculated using the optimal Linear Quadratic Regulator solution.

Both of these control methods utilize information in the far field, which is subject to many sources of noise. Both methods will be compared using a controller not based on far field information.