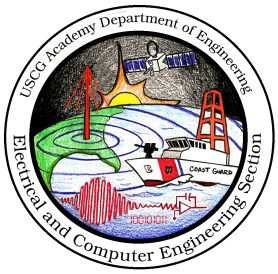

Senior Design Project in Electrical & Computer Engineering

LORAN Remote Control Using Kalman Filtering

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Project Goal

The goal of this project is to implement a LORAN- C timing control system using a Kalman Filter Algorithm and analyze performance against the current system and using no control algorithm at all.

Current LORAN-C control and timing equipment

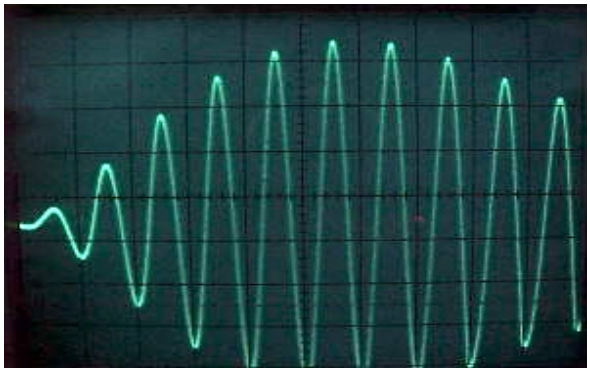
Project Plan

The Kalman Filter algorithm will be coded in C++ in the HP UNIX environment and tested using previously recorded data. Extensive study on performance differences between Linear Least Squares, Kalman Filtering, and no control will be completed and the best control method will be determined.

Status

The Kalman Filter Algorithm has been coded in MATLAB® for evaluation and comparison with Naval Post Graduate School results. Loran data sets are being processed for analysis. Once the program is done the algorithm will be coded in C++ on the Windows NT platform then on the UNIX platform for further evaluation.

LORAN-C pulse viewed on an oscilloscope



Project Background

Currently, the timing adjustments for all LORAN-C stations in North America are made at USCG Navigation Center using a Linear Least Squares Algorithm which allows for both manual and automatic adjustments.

A Kalman Filter Algorithm has been 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 evaluated or coded for implementation into the Loran Consolidated Control System (LCCS).

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

Both of these methods are controlling on information in the far field, which is subject to many sources of noise. Both methods will be compared to using no far field controller.