Description

The Extended Kalman Filter (EKF) is the non-linear version of the Kalman Filter that is suited to work with systems whose model contains non-linear behavior. The algorithm linearizes the non-linear model at the current estimated point in an iterative manner as a process evolves. Although EKF can be used in a very wide range of applications, the Radar Tracker example was chosen to demonstrate Altera's unique solution. Typically EKF requires significant computational efforts due to multiple matrix operations, including matrix inversion. This design demonstrates the possibility of offloading a CPU by executing a portion of the algorithm in FPGA fabric.

EKF algorithm can be partitioned to two distinctive parts: the application specific part, which includes non-linear models of the system, and the generic part, which doesn't change from system to system.

The Extended Kalman Filter reference design utilizes hybrid implementation architecture, which maps the application specific part to the Cortex™-A9 CPU in order to preserve maximum development, tuning and debug flexibility. The generic part is implemented in the FPGA fabric to maximize system performance. It is mapped to the Matrix Processor IP, which is a generic co-processing unit that executes a variety of matrix processing operations. The Matrix Processor can be run-time programmable to execute a sequence of different matrix operations using variable matrix sizes.

For additional information, please contact us at *mil@altera.com* or *contact your local Altera sales representative*.

Features

- Highly parameterizable Extended Kalman Filter engine
- Radar tracker hardware demonstration
- Overall system performance increase (> x2)
- Small FPGA footprint (< 10% Cyclone® V SoC)
- FPGA floating point matrix processor
- ARM Cortex-A9 and FPGA fabric performance
- Altera's System-in-the-Loop with MATLAB®
- Designed with Simulink®/Advanced DSP Builder

Applications

- Radar and Sonar
- Guidance and Navigation
- Inertial Navigation Sensors
- Sensor Fusion
- Motor Control
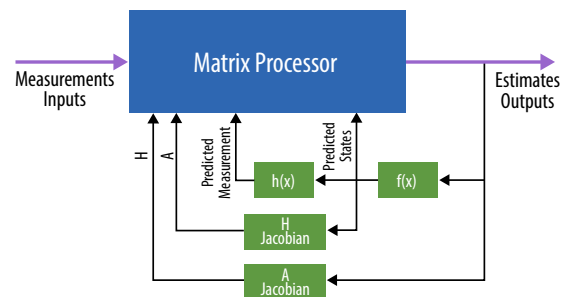
Figure 1: Extended Kalman Filter Hybrid Architecture

Figure 2: Extended Kalman Filter Reference Design Block Diagram

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