

Project Title

Optimizing Implementation of Kalman Filter

Group Members

Saurav Sachin Kale (EE19B141), Arun Krishna AMS (EE19B001), Surya Prasad S (EE19B121)

Project Proposal

- exploring the various ways a Kalman filter implementation can be optimized for both throughput as well as latency across multiple platforms
- will likely go beyond the traditional Kalman Filter to the extended version (EKF) for nonlinear systems, could try Adaptive/Unscented version
(as far as we have read, the basic one seems pretty doable, and the operations don't change extremely significantly from the basic to the extended filter)
- The platforms could possibly include FPGA, CPU and GPU. We will use Bluespec for FPGA (we might try HLS in addition to bluespec), C/OpenMP for CPU and CUDA for GPU
- Goal is to compare across implementations and determine the optimal implementation for various state space dimensional systems and applications
- Lower dimensional applications apparently benefit from more minimalistic architectures, while higher dimensions we might have to look at specialized architectures like systolic arrays. Other considerations include fixed point vs. Floating point (specially in the FPGA implementation), and how that influences accuracy and latency
- Possible hardware demo with real time sensor data (if we still have time, and it works out easily)

References

- https://www.researchgate.net/publication/317287905_Optimized_Parallel_Implementation_of_Extended_Kalman_Filter_Using_FPGA
- <https://ieeexplore.ieee.org/document/7979508>

Project Proposal submission by

Saurav Sachin Kale

EE19B141