VirginiaTech
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

# Computer Science Seminar Series, 2009

## National Capital Region

# Robust Kalman filters for Engineering and Climate Applications


### Speaker: Mital Gandhi
**Lockheed Martin**


### Friday, October 23, 2009
### 1:00PM- 2:00PM, NVC 325

### Abstract


Classical estimation methods such as the Kalman filter (KF) derive information about a system's states and parameters following certain assumptions. One of these is that the noise follows a Gaussian probability distribution. In practical systems though, one quite frequently encounters thick-tailed, non-Gaussian noise. Statistically, such contamination can be seen as inducing outliers among the data and leads to significant degradation in the KF. While many nonlinear methods to cope with non-Gaussian noise exist, a robust and statistically efficient filter that suppresses simultaneously occurring outliers is still needed. To solve this problem, a new robust Kalman filter framework is proposed that bounds the influence of observation, innovation, and structural outliers in a discrete linear system.

This talk will also addresses robust state estimation for systems that follow a broad class of nonlinear models consisting of two or more equilibrium points. Tracking state transitions from one equilibrium point to another rapidly and accurately in such models can be a difficult task, and a computationally simple solution is desirable. To that effect, a new robust extended Kalman filter is developed that exploits observational redundancy and the nonlinear weights of the GM-estimator to track the state transitions rapidly and accurately. Several examples highlight the unique problems associated with state estimation in the presence of outliers and state transition tracking in particular models. The utility of the new filters is demonstrated through simulations of the following applications: tracking autonomous systems, enhancing actual speech from cellular phones, and tracking climate transitions.


### Biography

Mital A. Gandhi's achieved the B.S. and M.S. degrees in Electrical Engineering from the University of Illinois at Urbana-Champaign in 2002 and 2004, respectively. He is currently a Ph.D. candidate in Electrical Engineering at Virginia Tech and a Research Engineer at Lockheed Martin, with interests in robust estimation, Kalman filtering, and statistical signal processing. He is expected be receive his PhD degree in November 2009.