

# The Field Robotics Center

## Seminar Series

Tuesday 24th April

GHC 2109 11am - 12noon

Pizza will be served



**Andrew Chambers**

Field Robotics Center

Carnegie Mellon University

### State Estimation from Visual-Inertial Data in Unstructured Environments

**Abstract:** In an unstructured, GPS-denied environment, vehicle state estimation is difficult and extremely important for operating an autonomous micro aerial vehicle. Inertial data from a low cost IMU and frame-to-frame stereo visual odometry measurements can be combined in a Unscented Kalman filter to provide high frequency, low latency state estimation. Relative measurements from visual odometry and noisy data from low cost IMUs present unique challenges when incorporated into a Kalman filter. Various techniques to use visual odometry measurements are discussed as well as methods for modeling and measuring IMU noise parameters. A camera-to-IMU calibration toolbox is presented and an analysis of the filter's sensitivity to errors in these parameters is performed. Final state estimation results are demonstrated on a 1.5kg rotorcraft to provide feedback for autonomous, closed-loop control in windy, outdoor conditions.

**Speaker Bio:** Andrew Chambers is a Masters student at the Robotics Institute, advised by Sanjiv Singh. He holds a B.S. in Electrical Engineering from the University of Southern California. Before coming to the RI, he worked as an electrical engineer at iRobot in Boston, MA, where he designed hardware for the bomb disposal robots.



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