

# ECE 8540 Analysis of Tracking Systems

## Fall 2022

### Objective

This course covers topics related to tracking systems, focusing on the filtering methods used to mitigate noise. It is assumed the student has a strong mathematical background and is proficient in MATLAB and C programming. Topics include model fitting and the normal equations, nonlinear solutions, Kalman filter, extended Kalman filter, particle filter, unscented transform, recursive Bayesian estimation, ultra-wideband position tracking and hidden Markov models. In labwork, several of these ideas are implemented.

Upon successful completion of the course, students will be able to apply mainstream filtering theories in the engineering (design, implementation, testing and debugging) of modern tracking systems. They will also be ready to pursue novel research problems involving tracking systems within the focus areas of intelligent systems and computer systems architecture.

### Suggested Texts

The course web site is <https://cecas.clemson.edu/ahoover/ece854>. Course notes will be the primary material and are available at that site. Some journal articles, book excerpts, dissertations and other materials are also supplied at the site. Attendance is mandatory.

### Professor

Dr. Adam Hoover  
313A Riggs Hall  
656-3377  
ahoover@clemson.edu  
office hours walk-in anytime, or by appointment

### Topics

Model fitting (least squares, least median of squares, normal equations) (2 weeks)  
Professional writing (1.5 weeks)  
State modeling, noise modeling (1.5 weeks)  
Kalman filter (1 week)  
Extended Kalman filter, unscented transform (2 weeks)  
Recursive Bayesian estimation, Particle filter (2.5 weeks)  
Ultra-wideband position tracking and the Global Positioning System (GPS) (1.5 week)  
Hidden Markov models (HMMs) for tracking non-visible systems (1 week)

Deep learning tutorial (TensorFlow, neural network layers, sample problems) (2 weeks)  
OR  
Mobile robot architectures (sense-plan-act, behavior-based, sensor networked, swarm) (2 weeks)

### Grading

100% eight labs (each is counted equally; some may be completed in more than one part)

### Attendance, Academic Integrity, Access Accommodations

This course follows all the procedures outlined in the ECE Common Course Syllabus.