

**CN 480 Fundamentals of Kalman Filtering for GPS/INS Integration**  
**ION GNSS 2007, September 25, 2006, 1:30pm-5:00 pm, CEU: 3.0**

**Instructor:** Dr. Mohinder S. Grewal, Professor of Electrical and Computer Engineering, California State University, Fullerton, CA.

**Prerequisites:** Knowledge of mathematics, GPS and INS basics will be helpful. Knowledge gained through experience or courses CN405/406 Fundamentals of GNSS II & II, and CN460/461 Introduction to Strapdown INS I & II will be helpful.

**Included Audience:** This course is for engineers, scientists and managers. It will cover the basics of Kalman filtering for GPS/INS integration.

**Notes provided:** Slides presented will be professionally spiral bound, with clear plastic cover, including color to add clarity where needed.

**Reference list:** A reference list will be provided as part of the note package for completeness and to allow the interested attendee to obtain additional information.

**Course Overview:** This course emphasizes the fundamentals of Kalman filtering with application to GPS/INS integration. It addresses subtleties, problems, and limitations of estimation theory as applied to real world situations encountered in GPS, INS, and navigation and provides application examples.

**Course Content:** The main topics to be covered in the course are

- Linear discrete Kalman filter
- Extended Kalman filter (for nonlinear plant and observation models)
- Unscented Kalman filter (for nonlinear plant and observation models)
- Square root Kalman filter ( $UDU^T$ )
- Kalman filter engineering
- Strapdown and gimbal IMU
- Loosely and tightly coupled INS/GPS
- Ultra tightly coupled INS/GPS
- Example: 8, 11, 17 states, with pseudoranges and delta pseudoranges
- Examples and demos with MATLAB®

**Course Outcomes:** At the completion of the course, attendees should understand the fundamentals of Kalman filtering and GPS/INS integration.