

CN562C Applications of Strapdown Inertial Navigation Systems (6.0 CEUs)

Instructor: Dr. Andrey Soloviev, Research Assistant Professor, University of Florida

Prerequisite: Some knowledge of mathematics and computer science will be useful. Additional benefit will be obtained with knowledge of strapdown inertial navigation systems (e.g., CN560C Introduction to Strapdown Inertial Navigation).

Intended Audience: Engineers, scientists, and managers interested in the application areas of strapdown inertial navigation systems. The course details various stand-alone and integrated applications of strapdown inertial navigation systems.

Course Overview: This course focuses on practical applications of the strapdown inertial technology. Types of inertial applications and the challenges of using strapdown inertial navigation system (INS) for practical application areas are addressed. Specific application examples for stand-alone and integrated INS navigation are considered with the emphasis on INS specification requirements and INS performance characteristics.

The second part of this course considers the use of INS for multi-sensor integrated applications. The emphasis is on the integration of INS with GNSS-alternative navigation aids such as video cameras and laser radars. The course introduces a generic approach for multi-sensor fusion that uses INS as a core navigation sensor. Types of the integrated solution are discussed and specific integration examples are provided. As a particular case study, the multi-sensor fusion approach is applied to integrate the INS with laser radar (ladar) for navigation in GNSS-denied environments.

The main topics to be covered by this course are:

Morning Session:

- Types of strapdown INS applications:
 - Stand-alone applications
 - INS as a core part of integrated navigation systems
- Inertial sensors:
 - Sensor specifications – what do they mean and how to “read” them
 - Main sensor technologies, their current state and perspectives
- Challenges of using strapdown inertial in practical application areas:
 - Sensor and packaging errors
 - Vibrations
 - Sculling and coning errors
- Example stand-alone INS applications:
 - Long-term inertial coasting for aviation applications
- Example integrated INS applications:
 - GPS/INS integration for weak GPS signal processing

Afternoon Session:

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- Generic approach for INS-based multi-sensor navigation
- Review of Kalman filter principles
- Types of the multi-sensor integrated solution
 - Loose integration
 - Tight integration
 - Deep Integration
- Range domain formulation of the INS-based multi-sensor fusion
- Case study: Ladar/INS integration for GNSS-denied navigation
 - Introduction to ladar-based navigation
 - Two-dimensional INS/ladar mechanization
 - Extension into a three-dimensional case
 - Performance demonstration with actual data

Course Topic Tailoring: GNSS Solutions can tailor the above course outline to meet your special needs or market. We can provide you more or less emphasis in specific areas, add or subtract topic areas. Feel free to [contact us](#) and discuss options for your course outline to maximize your benefit. Be sure to include any requested modifications when you [request a quote](#).

Handout Booklet: A booklet of the slide material presented will be provided. One Handout Booklet will be provided per student. The Handout Booklet will be professionally spiral bound with clear protective vinyl on the front and back cover (clear on front, navy blue on back). References will be provided on slides, as appropriate, and a reference list of significant material will be provided. Color will be provided on a limited basis where it is needed for clarity. This information will be copyrighted by the author and cannot be reproduced without the written permission of the author or GNSS Solutions if associated with this course. All color and/or password protected slide copies may be requested at additional cost.

Reference List: A reference list will be provided as part of the note package to allow the interested attendee to obtain additional information. Additionally, an acronym list will be provided.

Location: On-site at the Government and/or contractor facility. A local commercial location can be arranged by GNSS Solutions if requested.

Host Responsibilities:

- Facilities: Room, restrooms, seats, chairs, etc.
 - Refreshment access or provided (coffee, soda, snacks, etc.)
 - Scheduling of students and fund coordination.
 - LCD projector with screen and white/chalkboard (or equivalent).
 - No audio or video taping of the presentation is allowed.
- GNSS Solutions can provide the above items with proper coordination.

Day Schedule: The class room shall be available no later than 07:30 on class day, with presentation beginning at 08:30. A 15 min break will be scheduled every hour. One hour

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for lunch will be scheduled. The course will end at 16:30 every day. A total of 6 hrs of presentation time will occur each day. Different start, stop, break, and duration times can be accommodated.

Scheduling: A lead time of at least 3 weeks shall be used to schedule the course. A 10% deposited is required when ordering the course.

Rescheduling or Cancellation: Once the course has been ordered, the course can be rescheduled or canceled but fees may occur. The amount of these fees can be negotiated at the time of course rescheduling or cancellation. Generally, non-recoverable expenses (e.g., travel costs) may be forfeited in the event the course is rescheduled. If the course is cancelled, a 10% cancellation fee will apply.

Request a Quote: Please include the dates, location, number of attendees, and any exceptions, tailoring or special requests in your [request for quote](#).