ASEN 6091 GNSS Receiver Architecture

Fall 2019
Instructor: Y. Jade Morton

Office:	AERO N403	Class Time: Tu Th 1:00-2:15PM
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Overview:

This course investigates the overall architecture of satellite navigation receivers: including GNSS signal structure, analog radio frequency front end design (from antenna to analog-to-digital converter), GNSS signal acquisition and tracking methods and algorithms, and navigation data extraction using digital signal processing implementations. Such treatment of the operation of the receiver will provide insight into the trade-offs that go into GNSS as well as the more broad generic spread spectrum receiver design.

Prerequisites & Eligibility

ASEN 5090 Introduction to GNSS is a prerequisite for this course. This course is restricted to College of Engineering (ENGR) graduate students or Aerospace Engineering Concurrent Degree (C-ASEN) majors only.

Required Textbook

There is no required textbook for this course. Reading materials will be provided during the semester.

Subject Outline

1. GNSS signal structure and properties
2. Receiver analog radio front end
3. GNSS receiver digital signal processing
4. GNSS baseband data collection and processing

Assignments

This is a lecture-based course. The first part of this course is more conceptual while the second part is more algorithm-oriented. There will be several homework assignments during the first 5 weeks. For the remaining semester, students will be given 5 project assignments and one final project to practice concept and techniques taught in lectures. Student will build a software receiver function library based on these assignments. MatLab examples will be used in class. However, students have the option to use Python, Java, C++, or C.

Students do NOT need to turn in any homework assignments. Students do need to turn in the project assignments. The programs should be well documented and organized in appropriate hierarchy folders.

Tentative project titles are:

1. A GPS signal simulator
2. GPS signal coarse acquisition algorithms
3. GPS signal fine acquisition algorithms
4. GPS code tracking algorithms
5. GPS carrier tracking algorithms

Project team:

1. Each team may have 2 persons. If you want to work by yourself, that is fine too.
2. Team members may vary from one project to next.

Project Deliverables: The deliverables should be organized inside a folder shared with me via Google drive. The folder should contain the codes organized in an appropriate hierarchy. The folder should also include a short description of the algorithm and test cases. Students are expected to come to my office to demonstrate the code execution before due date.

Final Project

There will be a final project assignment during the last x weeks of the semester. Student will integrate the codes written during the semester to create a working software GPS receiver.

Grading Policy

Grades on individual assignments and for the overall course are set based on the following criteria:

- A/A-: Demonstrates superior understanding of the material beyond the course requirements, excellent technical work
- B+/B: Demonstrates comprehensive understanding of the material, strong technical work.
- B-: Demonstrates adequate understanding of the material, complete technical work.
- C: Demonstrates barely adequate understanding of the material and minimally sufficient technical work
- D: Poor technical work
- F: Unsatisfactory performance

Grades are allocated as the following:

Project assignments (15% for each project)	75%
Final project	20%
Class participation	5%
Total	100%

Class and University Policies

Students are required to be familiar with the university policies, which are highlighted below.

Disabilities: If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website and discuss your needs with your professor. This course requires the use of the Zoom conferencing tool which is currently not accessible to users using assistive technology. If you use assistive technology to access the course material, please contact your faculty member immediately to discuss.

Religious Obligations: Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please review the assignment calendar for this class and notify the instructor by email within the first 2 weeks of class if you have such a conflict. See full details at http://www.colorado.edu/policies/fac_relig.html.

Classroom Behavior: Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Class rosters are provided to the instructor with the student's legal name. I will gladly