

**ASEN 6091 / ECEN 5014**  
**Global Navigation Satellite System (GNSS) Receiver Architectures**

**Fall Semester 2022 – AERO N250**  
**Lecture Times: TTH 01:00 PM - 02:15 PM**

**(Lectures recorded/available via Canvas for online section of course offering)**

**Instructor: Professor Dennis M. Akos**

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Office Hours: anytime via zoom/inperson by apt (please email)

**Course Overview**

GNSS is a generic term describing the expanding field of satellite-based navigation/timing systems. The most prevalent of these systems currently is GPS which is owned and operated by the US. However, Russia maintains a system known as GLONASS. Both the European Union and China have/are developing their own GNSS system designated Galileo and Beidou (Compass), respectively. Lastly, there are a number of regional GNSS augmentation systems including but not limited to: WAAS (US), QZSS (Japan), EGNOS (EU), India (GAGAN) each of which provides GNSS corrections and, in some cases, ranging information.

There are a multitude of GPS receivers on the market today. Often times these receivers are embedded for monitoring

**Textbook (not required)**

A Software-Defined GPS and Galileo Receiver: A Single-Frequency Approach; K. Borre, D. Akos, N. Bertelsen, P. Rinder, S. H. Jensen; 2007; ISBN-10: 978-0-8176-4390-4

**Reference Material**

- 1) Course Notes
- 2) Understanding GPS/GNSS: Principles and Applications; E.D. Kaplan (Editor); 3<sup>rd</sup> ed; 2017; ISBN13: 978-1630810580
- 3) Global Positioning System: Signals, Measurements and Performance, P. Enge, P. Misra, 2<sup>nd</sup> ed; 2010, ISBN-13: 978-0970954428
- 4) ICDs for GPS - <http://www.gps.gov/technical/icwg/> (Also will refer to ICDs for other GNSS)
- 5) Akos' Lab Web Page: <https://www.colorado.edu/lab/rf-satnav/>
- 6) GNSS Software Receivers; Kai Borre, Ignacio Fernández-Hernández, José A. López-Salcedo, M. Zahidul H. Bhuiyan; Cambridge University Press; 2022; ISBN: 9781108934176
- 7) Position, Navigation, and Timing Technologies in the 21st Century: Integrated Satellite Navigation, Sensor Systems, and Civil Applications, Volume 1 & 2; Y. Jade Morton, Frank van Diggelen, James J. Spilker Jr., Bradford W. Parkinson, Sherman Lo, Grace Gao; Wiley-IEEE Press; 1st edition (9 Feb. 2021); ISBN-13 : 978-1119458418
- 8) Spread Spectrum Systems with Commercial Applications, R. C. Dixon, 3<sup>rd</sup> ed; 1994, ISBN13: 978-0471593423
- 9) Phase-Locked Loops : Design, Simulation, and Applications; R. Best; 6<sup>th</sup> ed; 2007; ISBN13: 978-0071493758

**Course Schedule**

Week(s)	1	Course Introduction & GPS Software Receiver Overview (Assignment 1)
Week(s)	2	Front End Design/Data Collection
Week(s)	3 & 4	GNSS Signal Acquisition (Assignment 2 & 3)
Week(s)	5 & 6	GNSS Signal Tracking (Assignment 4 & 5)
Week(s)	7	Navigation Data Decoding (Assignment 6)
Week(s)	8	Position Solution (Assignment 7)
Week(s)	9	Differential Position/Carrier Phase Solution (Assignment 8)
Week(s)	10	Midterm & Project Proposal
Week(s)	11-15	Project Work

Final Exam/Presentation                      Sunday Dec. 17 4:30–7PM (based on CU's final exam schedule)

**Course /Grades/Evaluation**

40% - Assignments



