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T/A: Hyun-chong Cho
Office: TBD
E-mail: hcho@ece.ufl.edu
Office hours: TBD
Meeting time: Tuesday 3:00-4:55, Thursday 4:05-4:55
Meeting place: NEB ???
References:

Send me an e-mail

Send me an e-mail with the subject heading, “Add me to ENS e-mail list.” It is essential that you get on the e-mail list and read your e-mail regularly. Also, you should check the class web page, referenced from my home page above, regularly. Vital information will be posted on the web page, such as handouts, assignments, and due dates.

Course prerequisites

Course content

Navigation is the determination of location with respect to an external reference system. Navigation is distinct from control and guidance in that long term accuracy is emphasized. Most modern navigation systems use a combination of inertial components and/or the global positioning system (GPS). Applications of GPS include navigation & tracking of ground vehicles, precision aircraft approach & landing, surveying & geodesy, measurement of deformation of large structures, and geophysical research. This class will focus on the theory of electronic navigation systems with about one third of the time spent on inertial systems and two thirds of the time spent on GPS.

The course will include the following topics:

- Mathematical background
- Coordinate systems – Earth centered inertial (ECI), Earth centered Earth fixed (ECEF), local level (ENU & NED)
- Inertial sensors – accelerometers, gyroscopes
- Inertial systems – mechanization equations, error equations
- Line of sight positioning – iterative solution, geometric dilution of precision (GDOP)
- Global positioning system – space segment, control segment, user segment
- Carrier phase positioning – single, double, & triple differences, integer cycle ambiguity estimation
- GPS error sources – satellite clock error & ephemeris error, tropospheric error & ionospheric error, multipath, interference & jamming, tracking loop errors
- Code & carrier tracking loops – phase lock loops, frequency lock loops, delay lock loops, loop filters, signal detection & acquisition
- Differential GPS – local-area and wide-area DGPS, attitude determination
- Kalman filtering – linear error models, state & error extrapolation, state & error update
- Integrated systems

Grading

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<tbody>
<tr>
<td>Homework</td>
<td>15%</td>
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<tr>
<td>Programming Projects</td>
<td>45%</td>
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<tr>
<td>Mid-term Exam</td>
<td>20%</td>
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<tr>
<td>Final Exam</td>
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There will be a series of Matlab programming projects: inertial navigation system error modelling, position from pseudo-range data, generation of coarse acquisition code, resolution of carrier phase ambiguities, and simulation of code tracking loops. Much more detail is available from the class web page.

**Homework**

Homework is to be done on an individual basis. Discussions about the homework of a very general nature between students are allowed and encouraged. However, your solution to each homework problem should be your own work.

Each homework problem will be graded on a scale from 0 to 3 as follows:

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<tr>
<th>Grade</th>
<th>Meaning</th>
<th>Approx. Percent</th>
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<tbody>
<tr>
<td>3</td>
<td>Substantially correct</td>
<td>85-100%</td>
</tr>
<tr>
<td>2</td>
<td>Mostly correct</td>
<td>50-85%</td>
</tr>
<tr>
<td>1</td>
<td>Shows some effort</td>
<td>0-50%</td>
</tr>
<tr>
<td>0</td>
<td>Not handed in</td>
<td>0%</td>
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Homework due dates will be announced in lecture and posted on the web. You should check the class web page frequently for updates. Homework solutions will be posted on the web soon after the homework is due. You should study the solutions for all homework problems, even if your solutions earned a “3”.

Late homework will not be accepted except in extraordinary circumstances.

**Labs**

Labs are also to be done on an individual basis. Discussions about the labs of a very general nature between students are allowed and encouraged. However, labs are to be done on an individual basis, not as group projects. All lab reports must include a signed lab honor statement, available on the class web page.

Your lab report should include any necessary code listings, plots, and a brief explanation of what you did. Any questions asked in the lab assignment should be answered in the formal style of professional journals; i.e., answers to questions must be fully explained in complete sentences, and each equation should be accompanied by a written explanation of what the equation means. All material should be labeled and organized to facilitate grading.

It is your responsibility to solve any computer problems, such as transfer of files between different operating systems or incompatibilities between compilers. I will do what I can to help, but the basic responsibility is still yours.

Lab due dates will be posted on the web. You should check the class web page frequently for updates. Late labs will not be accepted except in extraordinary circumstances.
Exams

I write difficult exams as a matter of principle. That being said, my expectations are not unreasonable, and I will do all I can (within reason) to help you do well. Make-up exams will not be given except in extraordinary circumstances.

Students with disabilities

Students with disabilities who are requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodations.

Academic honesty

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.