ENV-542

Advanced satellite positioning

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Cursus	Sem.	Type
Environmental Sciences and Engineering	MA2, MA4	Opt.
Microtechnics	MA2	Opt.
Space technologies minor	E	Opt.

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	1 weekly
TP	1 weekly
Number of positions	

It is not allowed to withdraw from this subject after the registration deadline.

Summary

All fundamental principals behind modern satellite positioning to acquire, track and evaluate direct and indirect satellite signals and process them for positioning and environment-monitoring applications.

Content

Concept of satellite positioning
- basic principals & reference frames
- orbit computation & simple positioning

Signal modulation and structure
- RF propagation in space
- signal structure

Receiver technology
- signal preprocessing
- signal acquisition & tracking

Error models and differencing concepts
- code and carrier phase measurements
- linear combination of observations

Algorithms for positioning
- code and carrier-phase smoothed-code
- carrier-phase cycle ambiguity determination

Algorithms for environmental sensing
- water vapor estimation
- total electron content estimation
- GNSS reflectometry

Keywords

GNSS, GPS, GLONASS, Galileo, Beidou, satellite, positioning, signal modulation, detection, estimation, signal processing

Learning Prerequisites

Recommended courses
Fundamentals of satellite positioning, signals and systems, or signal processing

Important concepts to start the course
Linear algebra, basic signal processing, statistics, programmation in Matlab

Learning Outcomes
By the end of the course, the student must be able to:
- Implement signal acqusition and tracking
- Develop estimation procedure for precise relative positioning
- Interpret error sources as signal of environment
- Apply orbit calculation and two algorithms for absolute point -positioning
- Synthesize a particular problem in GNSS for other students
- Solve carrier-phase ambiguities in geometry-free scenario

Transversal skills
- Make an oral presentation.
- Summarize an article or a technical report.
- Collect data.

Teaching methods
Ex cathedra, exercises (part in computer room), demonstrations

Expected student activities
Active participation in the course and lab assignments, programmation of algoritms and self-control (debugging), study of scientific papers.

Assessment methods
Continous control, 3 tests

Supervision
Office hours	No
Assistants	Yes
Forum	No

Resources
Bibliography
Recommended literature on Moodle.

Notes/Handbook
Slides, book chapter and scientific papers distributed via Moodle.

Moodle Link
- http://moodle.epfl.ch/course/view.php?id=13837

Prerequisite for

Sensor orientation