Summary
The students learn several techniques for spatial measurements, such as geodesy, aerial photogrammetry and laser scanning. They will be able to collaborate with geologists and civil engineers to master natural risks (landslides, avalanches) and to maintain infrastructures.

Content
Surveying techniques
- geodetic networks
- analogical and numerical aerial imagery
- photogrammetry
- terrestrial and airborne laserscanning
- GNSS phase measurement
- interferometry / InSAR

Coordinate systems and frames
- internal and external orientation
- classical aerotriangulation = indirect georeferencing
- with GPS, GPS+IMU = direct georeferencing
- orthophoto without aerotriangulation

Data quality
- geometrical and qualitative image analysis
- quality indicators for the positions

Specific applications
- mapping with a drone, Pix4D software package
- data for agriculture and forestry
- constructions: roads, bridges, dams
- combined monitoring methods

Keywords
Natural hazard, terrain movement, stability of constructions

Learning Prerequisites
Recommended courses
Statistics, Photo interpretation, Quantitative methods, Geodetic Engineering, Satellite positioning

Important concepts to start the course
Matlab programming, 3D data, least squares

Learning Outcomes
By the end of the course, the student must be able to:
• Describe various methods for spatial measurement of the environment
• Detect terrain movements within a project
• Design a monitoring scheme for natural hazards and construction sites

Transversal skills
• Summarize an article or a technical report.
• Make an oral presentation.
• Use both general and domain specific IT resources and tools
• Set objectives and design an action plan to reach those objectives.

Teaching methods
Lectures *ex cathedra* and exercises, partly in computer room.

Expected student activities
• Regular attendance at lectures
• Active participation in small groups for exercises

Assessment methods
50% continuous control during the semester (exercises and projects)
50% oral exam (20 min) during the exam session

Supervision
Office hours No
Assistants No
Forum No

Resources
Bibliography
Michel Kasser & Yves Egels "Photogrammétrie numérique", Collection ENSG – IGN (2001)
Karl Kraus "Photogrammetry: Geometry from Images and Laser Scans", de Gruyter (2007)
Articles divers, notes de cours, mode d'emploi des logiciels

Ressources en bibliothèque
• Manual of photogrammetry /
• Manuel de photogrammétrie / Kraus
• Cours de photogrammétrie / Kölbl

Notes/Handbook
• Méthodes d'estimation - Bertrand Merminod - dès 2012
• Localisation par satellites - Pierre-Yves Gilliéron - dès 2011

Moodle Link
• http://moodle.epfl.ch/course/view.php?id=8891
Prerequisite for
Advanced Satellite Positioning, Sensor Orientation