2SC6190 – Laser remote sensing (LIDAR) for optronic surveillance and target detection

Instructors: Delphine Wolfersberger
Department: DOMINANTE - PHYSIQUE ET NANOTECHNOLOGIES
Language of instruction: ANGLAIS
Campus: CAMPUS DE METZ
Workload (HEE): 40
On-site hours (HPE): 27,00

Description
This EI is based on the use of lasers as tools to control the infinitely small and the ultra-fast for, in particular, applications in the field of optronic surveillance and target detection. It is proposed to develop an innovative control-command solution for the generation of ultrashort laser pulses and the implementation of a photonic system whose intended application is laser telemetry (LIDAR: laser radar). These "lidars" have enormous potential for defense, the environment, security: mobile identification, gas detection, active imaging, ... The detection and identification of danger or targets is a key element of the defense and security systems , and are key elements for example devices developed by GDI Simulation for civil aviation or simulation of laser shooting for the training of the armed forces.

Quarter number
ST5

Prerequisites (in terms of CS courses)
None

Syllabus
The students will be divided into different groups each performing 4 practical works.
Practical Work Proposal:

1 / a session on the emitting laser: realization and characterization of a laser transmitter regulated in temperature so as to maintain its constant power
2 / a session on the generation of a laser pulse: study of the generation of a laser pulse via the use of an optical feedback loop
3 / a session on the shaping of the laser beam: shaping of the laser beam via the appropriate optics and / or via the use of a spatial light modulator (SLM) allowing ultimately the use of beams not Conventional (ex bundles of Airy)
4 / a session on the receiver: development of the device for receiving and analyzing the optical signal

These 4 sessions will be followed by a session on the synthesis of the different experiments for the realization of a telemetry device and possibly the development of the servo system necessary for the laser signal to reach the target.

Class components (lecture, labs, etc.)
Experimental and digital realization in team in the form of a challenge

Grading
Oral presentation in front of CS professors and industrial partner GDI Simulation

Resources
optical set-ups
Pedagogical Team : Delphine Wolfersberger - Nicolas Marsal

Learning outcomes covered on the course

The students will perform the experimental realization of the LIDAR using ARDUINO plat-forms. They will have:

i/ to understand the essential physical quantities related to an optical electromagnetic wave

ii/ design and realize a servo-driven photonic system

iii/ engineer and control innovative optical beams by exploiting spatial and temporal signal modulation techniques

iv/ make a choice of devices to answer an economic problem of sizing and energy consumption.

Recent advances in the realization of innovative optical beams will also allow the exploration of new beam topologies (e.g. Airy beams: non-diffracting, curvilinear trajectory, self-regenerating in case of obstacles) which open the way to improved performances (spatial resolution, speed, etc.).

Description of the skills acquired at the end of the course

C4 Have a sense of value creation for his company and his customers
C6 Be operational, responsible, and innovative in the digital world
C7 Know how to convince