AEROSPACE ENGINEERING (LM52)

(Brindisi - Università degli Studi)

Teaching RADAR SYSTEMS

GenCod A006600

Owner professor Giuseppe RICCI

Teaching in italian RADAR SYSTEMS

Teaching RADAR SYSTEMS

SSD code ING-INF/03

Reference course AEROSPACE ENGINEERING

Course type Laurea Magistrale

Credits 6.0

Teaching hours Front activity hours: 54.0

For enrolled in 2023/2024

Taught in 2023/2024

Course year 1

Language ENGLISH

Curriculum CURRICULUM AEROSPACE SYSTEMS

Location Brindisi

Semester First Semester

Exam type Oral

Assessment Final grade

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

A review of basic concepts from signal theory.
Generalities on radar signal processing (pulsed radars).
The radar equation (with general info on antennas and the radar cross section of a target).
A review from probability theory.
Detection theory and CFAR techniques.
Introduction to Matlab and Monte Carlo simulation.
Analysis (via Monte Carlo simulation) of selected decision schemes.
FMCW radars.

REQUIREMENTS

Knowledge (at an undergraduate level) of Signal and Systems and Probability Theory is highly desirable

COURSE AIMS	**Overview.** An introduction to the main concepts of radar systems with emphasis on radar signal processing. **Learning Outcomes**. ***Knowledge and understanding*** After the course the student should be able to describe 1.1) the main blocks of a radar system 1.2) signal and interference models 1.3) link budget analysis 1.4) the use of detection theory to design a radar receiver 1.5) CFAR techniques ***Applying knowledge and understanding*** After the course the student should be able to 2.1) Formulate and solve simple detection problems resorting to the optimum (i.e., Neyman-Pearson test or UMP test) if possible or to a suboptimum one (GLRT). 2.2) Evaluate the performance parameters of a radar system for simplified scenarios by Monte Carlo simulation (Octave/Matlab project). ***Making judgements*** Students should acquire the ability to compare pros and cons of different approaches to the solution of a specific problem through examples and problems. ***Communication*** The ability to communicate on technical topics should be acquired by discussing the adopted solution to a specific problem with a good balance of mathematical rigor and physical insights. ***Learning skills*** Selected problems will be proposed that require elaborating on introduced concepts and methods. Identifying solutions to non trivial problems, also with the help of the instructor, will be important to be ready for autonomous lifelong learning.
TEACHING METHODOLOGY	Lectures, assigned homeworks, solution to proposed problems, and computer projects.
ASSESSMENT TYPE	Oral exam. The exam consists of a first part devoted to the discussion of a couple of theoretical topics (this part is aimed at assessing to what extent the student has gained knowledge of topics 1.1-1.5, see Course aims) and a second part focused on the discussion of a Matlab project or the solution of a simple detection problem (this part is aimed at verifying to what extent the student is able to apply knowledge and understanding). Knowledge of topics 1.1-1.5 is necessary to pass the exam together with the ability to discuss a project developed during the course. For scores above 24/30 an in depth knowledge of the mathematical aspects of topics 1.1-1.5 is also required. For scores above 28/30 the ability to solve a simple detection problem is also requested.
REFERENCE TEXT BOOKS	Radar Principles by Nadav Levanon, John Wiley & Sons, 1988. Handouts (in progress).