

230251 - RAD - Radar

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
 Teaching unit: 739 - TSC - Department of Signal Theory and Communications
 Academic year: 2019
 Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010).
 (Teaching unit Optional)
 BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010).
 (Teaching unit Optional)
 BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING
 (Syllabus 2015). (Teaching unit Optional)
 ECTS credits: 6 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: ANTONI BROQUETAS
 Others: Broquetas Ibars, Antoni

Prior skills

Radiation and Propagation, Signals and Systems, Probability and Stochastic Processes

Teaching methodology

- Lectures
- Application classes
- Exercises

Learning objectives of the subject

We present the fundamentals and techniques of radio detection, location and estimation of parameters of distant bodies. The course has a telecom. system orientation combining a wide range of technical disciplines seen in previous courses applied to aerospace, navigation and industrial needs.

Study load

Total learning time: 150h	Hours large group:	52h	34.67%
	Self study:	98h	65.33%

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Content

<p>1. Introduction: Radar and Telecommunications</p>	<p>Learning time: 16h Theory classes: 8h Self study : 8h</p>
<p>Description: Radar: A case of telecommunication system. Historical milestones in the development of radar. Types and examples of radar.</p>	
<p>2. Pulsed Radars</p>	<p>Learning time: 48h Theory classes: 24h Self study : 24h</p>
<p>Description: Basic principles of operation. Block diagram of a pulsed radar. The spatial exploration of radars: 2D and 3D systems. Resolution in range and angle. Radar Range (Power) equation: Radar Cross Section. The radar receiver. Matched Filter. Radar Detection: Probabilities of detection and false alarm. Pulse Integration. Applications in aerospace and marine navigation.</p>	
<p>3. Continuous Wave Radars</p>	<p>Learning time: 16h Theory classes: 8h Self study : 8h</p>
<p>Description: Doppler radar. Block diagram of a CW radar. Determination of the target velocity. FM-CW radar: Determination of target range and velocity. Examples and Applications.</p>	
<p>4. Pulse compression</p>	<p>Learning time: 24h Theory classes: 12h Self study : 12h</p>
<p>Description: The Dilemma of Energy and Resolution. Passive techniques and active compression pulses. Equation power radar pulse compression. The radar ambiguity function and properties. Resolution and precision in the estimates of distance and speed. Xirp signal analysis and coded pulses (Barker, Frank, etc.).</p>	

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5. Moving Target Detection	Learning time: 23h Theory classes: 6h Practical classes: 2h Self study : 15h
Description: Interference caused by the target environment (Clutter), properties and models. Coherent techniques for detecting moving targets: MTI, MTD. Adaptive threshold detectors: Temporal and Spatial CFAR detectors. Characterization of coherent and incoherent detection techniques. Examples and Applications.	

Planning of activities

EXERCISES	Hours: 26h Theory classes: 26h
Description: Collection of problems (with solutions)	
CONTROL based on problem solutions	Hours: 1h 30m Theory classes: 1h 30m
Description: Short mid-term test at the end of Chap.2	
EXTENDED ANSWER TEST (FINAL EXAMINATION)	Hours: 2h 30m Theory classes: 2h 30m
Description: Final Exam. Based on problems solution.	

Qualification system

Final examination: 60%
 Partial (Control) examination: 40%

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Bibliography

Basic:

Richards, M.A.; Scheer, J.A.; Hoolm, W.A. (eds.). Principles of modern radar: vol. 1: basic principles. Raleigh: Scitech Publishing, 2010. ISBN 978-1-891121-52-4.

Skolnik, M.I. Introduction to radar systems. 3rd ed. Boston (Mass.): McGraw-Hill, 2001. ISBN 0072909803.

Complementary:

Eaves, J.L.; Reedy, E.K. Principles of modern radar. New York: Chapman & Hall : ITP International Thomson Publishing, 1987. ISBN 9781461291701.

Levanon, N. Radar principles. New York: John Wiley and Sons, 1988. ISBN 0471858811.