Universitat Autònoma de Barcelona

2018/2019

Linear Networks

Code: 42851
ECTS Credits: 6

Degree	Type	Year	Semester
4313797 Telecommunications Engineering	OB	1	1

Contact

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Use of languages

Principal working language: english (eng)

Prerequisites

A background in microwave engineering is recommended.

High level of mathematics is required.

Objectives and Contextualisation

Objectives

The aim of this module is to provide the ability to design components for communications, with particular emphasis on synthesis of linear components, from the mathematical definition of the response to a circuital network, lumped element based, which has the desired response. Different technologies connected to the network synthesis approach will be analyzed. Examples and exercises will be implemented for better understanding of the content.

Skills

- Capacity for working in interdisciplinary teams
- Capacity to design communications components such as routers, commuters, concentrators, emitters and receivers in different bandwidths.
- Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent
- Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study
- Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously

Learning outcomes

1. Capacity for working in interdisciplinary teams
2. Choice of the most appropriate technology for subsequent design in terms of performance and band frequency.
3. Design linear devices at different bandwidth frequencies

4. Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent
5. Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study
6. Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously
7. Synthesis devices with linear responses at different bandwidth frequencies

Content

Content

- Introduction.
- Fundamentals of Circuit Theory Approximation.
- Characterization of Lossless prototype Filter Functions.
- Synthesis of a general class of the Chebyshev Filter function.
- Coupling matrix synthesis of filter networks.
- Physical realization of a Cavity Filter by means of the Coupling Matrix.
- General Extracted Pole Synthesis.
- Synthesis methodology for the design of Acoustic Wave Ladder Filters and Duplexers.

Methodology

Content

- Introduction.
- Analysis of multi-port networks. Parameter definitions.
- Mathematical synthesis of the transfer function.
- Network synthesis - Circuit approach.
- Coupling matrix synthesis.
- Reconfiguration techniques.
- Technology and design techniques.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Exercises	7	0.28	
Lab	12	0.48	
Theory classes	26	1.04	
Type: Supervised			
Tutorials	15	0.6	
Type: Autonomous			
Lab and exercises preparation	17.5	0.7	
Study	65	2.6	

Evaluation

Evaluation

Laboratory (30%)

Student's ability to solve practical problems will be assessed taking into account submitted reports, autonomy in problems resolution during lab sessions, ability to work as a team with other students and diligence.

Exam 1 (20%)

MId-course exam to check the propper evolution of the student.

Final Exam (40%)

A final exam will be done at the end of the term including the contents of the subject.

Attendance and Participation (10%)

The attendance to classes and different activities along the course will be a part of the evaluation. Autonomous work and participation in the proposed activities will also determine a part of final marks.

Final grade = Lab*0.3 + Exam1*0.2 + Final Exam*0.4 + Attendance*0.1

In the case that the student does not participate in any of the activities presented above, his qualification will be "No qualification".

The mark for Final Exam has to be higher or equal to 4 to be included in the final avaluation calculation. An extra exam will be carried out if the final mark is below 5.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Attendance and Participation	10%	0.5	0.02	
Exam 1	20%	2	0.08	3, 4, 5, 7
Final Exam	40%	2	0.08	2, 3, 4, 5, 6, 7
Laboratory	30%	3	0.12	1, 2, 3, 4, 5, 6, 7

Bibliography

J. S. Hong, Microstrip Filters for RF/Microwave Applications, 2nd ed., Wiley, 2011.

R. J. Cameron, C. M. Kudsia and R. R. Mansour, Microwave filters for communication systems: fundamentals, design, and applications. Wiley, 2007.

R. E. Collin, Foundations for Microwave Engineering, McGraw-Hill, 1966.

D. M. Pozar, Microwave Engineering, Wiley, 2009.