

Sensors i Actuadors Orientats a les Tecnologies de la Informació 2014/2015 i la Comunicació

Codi: 42847

Crèdits: 6

Titulació	Tipus	Curs	Semestre
4313797 Enginyeria de Telecomunicacions / Telecommunication Engineering	OT	2	1

Professor de contacte

Nom: Gabriel Abadal Berini

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Utilització de llengües

Llengua vehicular majoritària: anglès (eng)

Grup íntegre en anglès: No

Grup íntegre en català: Sí

Grup íntegre en espanyol: No

Equip docent

Jordi Naqui Garolera

Prerequisites

No pre-requirements are needed

Objectius

There are two main objectives: first of all, the main transducing mechanisms involved in the sensing and actuating operations of mobile devices such as electrostatic, electrodynamic, piezoelectric, piezoresistive, optoelectronic and thermoelectric will be introduced. Based on real applications, the most significant examples of sensors and actuators found in ICT portable devices will be reviewed and analysed. The second objective is focused on the principles and design strategies for RF/microwave and wireless sensors for wireless communications and sensing, including examples in real applications.

Competències

- Capacity for critical reasoning and thought as means for originality in the generation, development and/or application of ideas in a research or professional context.
- Capacity for developing electronic instrumentation as well as transducers, actuators and sensors.
- Capacity to apply advanced photonic and optoelectronic knowledge , as well as high frequency electronics
- 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 communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously

Resultats d'aprenentatge

1. Capacity for critical reasoning and thought as means for originality in the generation, development and/or application of ideas in a research or professional context.
2. Characterize the transducer elements of sensors and actuators.

3. Design RF and wireless sensors for application in industrial and medical environments, etc.
4. Design sensors and actuators for mobile devices and selfpowered systems
5. Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent
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. Use electromagnetic simulation tools to design RF sensors and wireless sensors

Continguts

PART I

Unit 1. Transducing mechanisms.

Electrostatic, piezoelectric, electrodynamic, piezoresistive, optoelectronic and thermoelectric. SPICE models.

Unit 2. Sensing and actuating devices.

Microphone, pressure sensor, gas sensor, inertial sensor, light sensor, pico projector, micro speaker

Unit 3. Self-powering technologies. The Energy Harvesting concept.

Power consumption levels in ICT devices. Limits of battery technology. Energy harvesting strategies.

PART II

Unit 1. Principles and main types of RF/microwave sensors and wireless sensors. Examples. Position and alignment sensors, rotation speed sensors, gas and temperature sensors, etc.

Unit 2. Balanced sensors and comparators. Examples. Sensors for medical applications.

Unit 3. Other RF-based sensors: Radar sensors, RFID sensors and bar codes.

Metodologia

Classroom lectures

Laboratory sessions: simulation and characterization of transducer elements and sensing devices

Activitats formatives

Títol	Hores	ECTS	Resultats d'aprenentatge
Tipus: Dirigides			
Classes a l'aula	30	1,2	3, 4, 5
Sessions pràctiques de laboratori	15	0,6	1, 2, 3, 4, 7
Tipus: Supervisades			
Elaboració informe escrit i presentació oral dels resultats de pràctiques de laboratori	20	0,8	1, 2, 3, 4, 6, 7
Tipus: Autònomes			
Estudi material docent y bibliografia	73	2,92	1, 3, 4, 5

Avaluació

Part I

Written exam (70%)

Final work, oral and written report (30%)

Part II

Written exam (70%)

Report and results of the lab exercises (30%)

The final score will be the average of the evaluation of the two parts. The professors in charge of the subject reserve the right to slightly modify the evaluation procedure, if it is deemed necessary.

Activitats d'avaluació

Títol	Pes	Hores	ECTS	Resultats d'aprenentatge
Examen final	70%	4	0,16	1, 6
Presentació resultats pràctiques laboratori. Oral i escrit	30%	8	0,32	1, 6

Bibliografia

Sensors. Vol.7. Mechanical Sensors. W. Göpel, J. Hesse, J.N. Zemel. Wiley-VCH.

Sensors (Update). Vol.4. H. Baltes, W. Göpel, J. Hesse. Wiley-VCH.

Practical MEMS. Ville Kaajakari. Small Gear Publishing. ISBN: 978-0-9822991-0-4 (2009).

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Sensors and transducers, M.J. Usher and D.A. Keating, Ed. Macmillan, London, Second Edition 1996.

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Sensors and signal conditioning, Pallás Areny, Ramón, John Wiley & Sons, New York, 2nd ed (2001).

Handbook of modern sensors: physics, designs, and applications. Fraden, Jacob. Springer-Verlag New York Inc., cop. 3rd ed (2004).

ICT - Energy - Concepts Towards Zero - Power Information and Communication Technology, Giorgos Fagas, Luca Gammaitoni, Douglas Paul and Gabriel Abadal Berini, ISBN 978-953-51-1218-1, Publisher: InTech (Open Access) (2014).

Planar Metamaterial Based Microwave Sensor Arrays for Biomedical Analysis and Treatment, M. Puentes, Springer.

Artificial Transmission Lines for RF and Microwave Applications, F. Martin, Wiley.