MICRO-712

Piezoelectric bulk and surface acoustic devices

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Cursus	Sem.	Type
Microsystems and Microelectronics		Opt.

Language of teaching	English
Credits	2
Session	
Exam	Term paper
Workload	60h
Hours	**25**
Lecture	25
Number of positions	**30**

Frequency

Only this year

Remark

March 1-13: Self-paced videos & lecture notes / March 14-18: Q&A sessions / Week of March 21: Oral exam

Summary

Course dealing with the design and fabrication of fundamental components of smart phones front-end communication (filters, duplexers, quadplexers).

Content

Basic Physics: waves and vibrations (10h)
1. Fundamentals of theory of elasticity
2. Acoustic waves in isotropic solids
3. Reflections and refractions of elastic waves
4. Rayleigh Surface Acoustic Waves (SAW) in isotropic media

Acoustics of crystals (10h)
5. Piezoelectricity and Electro-mechanical coupling
6. Acoustic waves in piezoelectric materials and Anisotropy
7. Energy flow, phase and group velocities
8. How do crystal (quartz) resonators operate?
9. Thin Film Bulk Acoustic wave Resonators (FBARs)
10. Generation of bulk acoustic waves by piezoelectric transducers
11. Different types of SAW in piezoelectric crystals: Rayleigh type SAW, Bleustein-Gulyaev waves, "leaky" SAW, STW, etc

SAW and FBAR Devices (5h)
12. Interdigital transducer (IDT) â## elementary theory and properties
13. SAW reflectors, unidirectional transducers, multistrip couplers, waveguides
14. Ladder filters & duplexers

Note

Invited Speaker: Victor Plessky

Keywords

SAW, FBAR, Electromechanics, Electroacoustics, Filters, RF

Learning Prerequisites

Required courses

Knowledge of basic physics (oscillations, waves, diffraction, alternative currents, impedance) and math (matrixes, linear diff. equations, complex variables) is required. Knowledge of Scaling laws and Microfabrication is recommended.

Resources

Bibliography

[1] D. Royer, E. Dieulesaint, Elastic waves in solids, Springer, 2000
[2] Ken-Ya Hashimoto, SAW Devices in Telecommunications: Modelling and Simulation, Springer, Apr 2013.

Ressources en bibliothèque

- Elastic waves in solids / Royer
- SAW Devices in Telecommunications: Modelling and Simulation / Hashimoto