DRIEI
PhD Program in Electronic and Computer Engineering
University of Cagliari, Italy

Seminar: New frontiers of breast imaging based on the use of millimeter waves: presentation of the design steps and practical course on phantom development

Instructor: Dr. Simona Di Meo - – University of Pavia

SSD: IINF02/A

Credits / hours: 1 credits / 10 hours

Language: English

Scheduling: 21-22-23-24 / October

Final Exam: Written

Website:

Goal of the Seminar

Breast cancer is one of the most widely diagnosed diseases among women in the world. Studies show that the likelihood of success in fighting the disease increases when cancer is diagnosed early. Various diagnostic imaging techniques are available to date, including for screening purposes (as in the case of mammography). However, the limitations of current techniques are motivating interest in new imaging methods; among the emerging technologies, those based on the use of microwaves and millimeter waves are increasingly being studied, as they represent low-cost and safe alternatives for patients. In this seminar course, the methods adopted in each of the design steps involved in the development of such an imaging system will be analytically presented and discussed. Particular emphasis will be given to the realization of phantoms to emulate the dielectric characteristics, and more, of human tissues, these being functional for testing any brand-new microwave-based biomedical prototype.

Prerequisites

Prior exposure to the fundamentals of electromagnetics

Intersection with other courses at the University of Cagliari

There is no significant intersection with other courses offered in the PhD programme DRIEI and in the Master Degrees at UniCa.

Course Outline

- Introduction to microwave imaging in oncology, with special reference to its use for breast cancer diagnosis - Presentation of the clinical context.
- Presentation of dielectric characterization campaigns of ex-vivo human breast tissues in the frequency range from 500 MHz to 50 GHz: measurement protocol and statistical analysis of results.

- Numerical feasibility study of millimeter-wave imaging systems for early detection of breast cancer.
- Design and fabrication of phantoms to emulate the dielectric (up to 50 GHz) and mechanical characteristics of human breast tissues – Fabrication of single and multi-layer phantoms, with one or more inclusions (practical session).
- Presentation of experimental setup for acquisition of Scattering parameters both with and without the phantom.
- Presentation of the radar beamforming algorithm (Delay-And-Sum) for image reconstruction.
- Presentation of future perspectives of millimeter-wave imaging for breast cancer diagnosis.