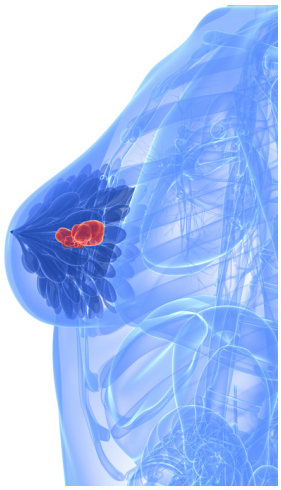
INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Method for Large-Domain Microwave Breast Imaging

TECHNOLOGY NUMBER: 4751



OVERVIEW

Microwave inverse scattering algorithms for breast tissue imaging

- Provides quantitative imaging with physically meaningful regularization
- Breast cancer diagnosis, medical imaging, complementary diagnostic tool to mammography

BACKGROUND

Microwave imaging technologies aim to map the dielectric properties of objects, specifically focusing on permittivity and conductivity. Traditional methods like X-ray mammography and ultrasound are widely used for medical imaging but have limitations, such as potential exposure to harmful radiation and varying accuracy. Microwave imaging offers a non-ionizing alternative but requires sophisticated computational techniques to translate scattered electric fields into meaningful images. Historical approaches in microwave imaging have struggled with computational intensity and the lack of physically meaningful regularization. Accurate imaging necessitates solving complex inverse problems where experimental data must closely match predicted fields generated by a forward model. This procedure calls for highly advanced algorithms that can handle large datasets and produce stable images. Given rising interest in non-invasive diagnostic tools, there is a critical need for improved algorithms that can deliver reliable, quantitative images for medical diagnostics.

Technology ID
4751

Category
Software
Engineering & Physical Sciences
Semiconductors, MEMS, and Electronics

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INNOVATION

This innovation introduces an advanced microwave inverse scattering algorithm designed for quantitative breast tissue imaging. Utilizing Born iterations, the algorithm begins by assuming the initial object field as the incident field. A multi-objective covariance-based cost function minimizes the error between measured and predicted electric fields without requiring large matrix computations. A wave simulator, employing the Neumann series solution, iteratively refines the object field for improved accuracy. Full-wave electromagnetic solvers ensure a comprehensive portrayal of wave propagation, and the algorithm incorporates models of antennas in both transmitting and receiving modes. This method achieves stable and robust imaging while employing physically meaningful regularization based on Gaussian prior distributions. The innovation facilitates realistic large-domain imaging, making it a viable tool for diagnosing breast cancer, thus providing a complementary technology to existing diagnostic methods like X-ray mammography and ultrasound, enhancing early detection and treatment strategies.

ADDITIONAL INFORMATION

INTELLECTUAL PROPERTY:

US9329263 "Imaging system and method"