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Design of a Flexible Textile Antenna for Early Breast Tumor Detections
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Abstract
The breast tumor is the form of tumor that is diagnosed more frequently than any other type of tumor and it is the leading cause of death from breast cancer among females globally. Breast cancer has the greatest incidence and fatality rate among women worldwide. Early on, it was largely elderly women who were affected, but that has since shifted. Younger women have been more affected by breast tumor in recent years. The most effective methods for dealing with this condition right now include screening for it in early stages and diagnosing it. Rather than relying solely on traditional approaches, it encourages the researcher to instead focus on cutting-edge technologies. Objectives: Breast tumor detection using a textile-based (jeans) flexible antenna. Methods: As a substrate, jeans serve as a model for the proposed textile antenna, while copper serves as a patch (tuning fork shape) and ground plane in a simulated version of the antenna. Multiple simulations were run on CST MWS-2021 to determine the return loss (S11), VSWR, 3D & 2-D radiation pattern, surface current radiation efficiency (%) with a focus on the specific absorption rate (SAR) all of which are important for optimizing antenna performance and ensuring human safety in the presence of electromagnetic waves. In order to guarantee the identification process for tumor of varying sizes (R=10, 20 & 30 mm), the return loss results are compared across several cases. The tuning fork shape textile antenna operates on ISM band (5.79 GHz). Findings: With the primary goal of identifying breast tumor, the proposed structure was designed with a flexible textile substrate (jeans), low cost and an excellent radiation efficiency %. Application: The proposed structure is a significant improvement over prior studies in terms of low fabrication cost, adaptability and radiation efficiency %, directivity, SAR value. The SAR value was simulated and found 1.37 W/Kg, 0.837 W/Kg for 1 gm and 10 gm tissue. The suggested antenna meets the SAR standards given by the FCC (1 gm) and the ICNIRP (10 gm). The most significant advantage, however, is that the proposed antenna can be used in conjunction with microwave scattering technology to aid in the identification and detection of breast tumor with just a marginal difference between healthy and unhealthy breast. © 2023 IEEE.

Author Keywords
breast tumor; cancer; ISM band; jeans; SAR; textile antenna; tuning fork

Index Keywords
Antenna grounds, Costs, Diagnosis, Directional patterns (antenna), Diseases, Microstrip antennas, Microwave antennas, Slot antennas, Textiles, Tumors, Tuning, Wearable antennas; Breast Cancer, Breast tumor detection, Breast tumour, Cancer, ISM bands, Jean, Radiation efficiency, Specific absorption rate, Textile antennas, Tuning-fork; Radiation efficiency

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