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Entitled

METAMATERIAL-BASED SENSOR DESIGN USING SPLIT RING RESONATOR AND HILBERT FRACTAL FOR BIOMEDICAL APPLICATION

by

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Abstract

In this research, a simple and efficient approach is presented to design a metamaterial-based sensitive sensor for biomedical applications. The metamaterial-based sensor is designed to differentiate the different types of cancer cell lines based on their electrical properties. The sensor is designed by incorporating a single circular split ring resonator (SRR) and a Hilbert fractal curve. The SRR is used considering its capacitive and inductive resonance properties, thereby making the SRR a favorable candidate for sensing applications. Moreover, the Hilbert fractal curve was used as a defected ground structure to increase sensor sensitivity and selectivity. The Hilbert fractal ground will increase the capacitance and inductance of the sensor, thus increasing the sensor sensitivity. Different Hilbert curve orders were investigated. The fourth-order Hilbert curve was used in the final design because it showed the optimal performance among the orders. To verify the sensor functionality and selectivity, the proposed sensor was tested through three breast cancer cell lines. Measurement results were compared to simulated results obtained using high-frequency structure simulator. In addition, support vector machine, which is an artificial neural network (ANN), was developed to classify the type of each cancerous cell based on resonance frequency.

Keywords: metamaterial, split ring resonator, Hilbert defected ground structure, biosensor.