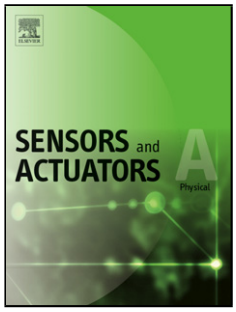

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Design and validation of liquid permittivity sensor based on RCRR microstrip metamaterial

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Highlight

In this paper, based on the microstrip metamaterial composed of two coupled square rings, a novel liquid permittivity sensor is designed and fabricated. The sensor takes advantage of the coupling between two square rings connected by interdigital capacitor. Relatively low frequency is achieved with compact dimension. It realizes relatively high sensitivity and the bandwidth is less than 100MHz at working frequency of 900MHz. Equivalent circuit is given and in well agreement with simulations. The experimental results are well in agreement with simulated results, too.

Abstract

In this paper, based on the microstrip metamaterial composed of two coupled square rings, a novel liquid permittivity sensor is designed and fabricated. The sensor takes advantage of the coupling between two square rings connected by an interdigital capacitor. It realizes a relatively high sensitivity, and the bandwidth is less than 100 MHz at a working frequency of 900 MHz. The resonance frequency shifts from 810 MHz to 689.5 MHz when the real part of the sample's relative permittivity shifts from 1 to 78. The experimental results are in good agreement with simulated results. The designed sensor with compact dimensions and operating frequency paves the way for application to the Internet of Things.

Key Words: Metamaterial; microstrip; sensor; permittivity

1. Introduction

Metamaterials are artificially engineered materials with physical properties that are different from those of natural materials, such as a negative refraction index, cloaking, and perfect lenses [1–3]; hence, they have attracted great attention and more researchers are working to develop them for many applications.

Left-handed materials (LHM) were first realized with a negative refraction index in