Filtering Giga Hertz Frequency Source by Split Ring Resonator of Metamaterial Hexagonal Structure

There are a number of characteristics that make metamaterial has wide applications and has been researched at present, such as negative phase, negative index of refraction, super resolution, and reverse of Doppler's effects. This paper investigates a hexagonal metamaterial structure with a split and a double concentric rings so-called split ring resonator hexagonal (SRR-H) for frequency filtering application. SRR-H is designed structurally and operated computationally for frequency range of 1 GHz to 120 GHz. The simulation results showed that SRR-H size will affect the resonant frequency significantly. The resonant frequency tends to shift the lower frequency when the size of the structure is enlarged. The properties of the structure SRR-H, such as permeability, permittivity and the refractive index have a similarity because it is dominated by the properties of permeability. Metamaterial SRR-H successfully responded to double negative and agreed with Lorentz's model. The SRR-H is also tested and computed in the 300 GHz - 300 THz frequency range with outer and inner radii of SRR-H from 0.5μm and 0.36μm to 0.35 μm and 0.21 μm respectively. From simulation results, it is shown that the SRR-H size has an effect on the excitation delivery of magnetic resonance at different frequencies. The largest refractive index value occurs at low frequency with the refractive index of -6.0242 obtained at the frequency of 9.765 THz for the variation in SRR-H structure. The resonant frequencies tend to shift to higher frequencies based on the hexagonal shaped SRR.

Keywords: optical metamaterial; Split Ring Resonator; hexagonal