TUNEABLE MAGNETIC METAMATERIALS

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The recent rediscovery of negative index phenomena has generated an enormous interest in the field of Electromagnetic (EM) Metamaterials. So far the attention was mostly given to non-magnetic materials, in which the structuring of metals can lead to RF currents acting as an effective magnetisation. Here we consider an alternative case of metamaterials based on magnetic materials, for which the variation of permeability is the result of magnetic dynamics. It is well known that magnetic permeability undergoes a drastic change near the resonance frequency/field and can also change sign. Although for purely magnetic systems, such as transition thin film metals, this is a natural phenomena, combining it with typical EM systems, for instance a microwave patch antennae, is not trivial. Here we considered an application of a hypothetical composite material with structurally correlated ferromagnetic elements, such as 'magnonic' medium. In which the nanostructuring removes the conductivity, whereas anisotropy is provided by the shape. We simulate a dynamic response of a microwave patch antennae, as a basic element of metamaterial, filled with the magnetic medium and show the absorption spectrum of reflection. We demonstrate the splitting of dynamic EM modes by the magnetostatic excitations and tuning the reflection spectra by the external magnetic field.

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