EFFECTIVE PARAMETERS OF FERROELECTRIC DIELECTRIC MIXTURES

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ABSTRACT

We investigate the homogenized parameters of ferroelectric-dielectric composites under a static electric field. A numerical model that takes into account the coupling between the electrostatic problem and the electric field dependent permittivity of the ferroelectric material is used. Metamaterials consisting of periodic and random arrays of rods are considered for transverse electric polarization case and we study their effective permittivity, losses, electrically induced anisotropy and tunability by a two scale convergence homogenization method.

METHOD

Ferroelectric materials play a crucial role in reconfigurable microwave devices, with typical applications including antenna beam steering, phase shifters, tunable power splitters, filters, voltage controlled oscillators and matching networks [**tagantsev_ferroelectric_2018**].

Ferroelectric permittivity

$$\varepsilon^{\mathrm{f}}(E) = \left[\frac{\partial^2 F(P,E)}{\partial P^2}\right]^{-1} = \frac{\varepsilon^{\mathrm{f}}(0)}{1+\alpha P_0^2+\beta P_0^4}, \qquad (1)$$

Normalization of modes

Expansion of the coupled modes

REFERENCES

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