Near Field inductive coupling in Terahertz Metamaterials

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The short range coupling in metamaterials occurs via the electric and magnetic fields due to the close proximity of the neighboring resonators. The electric field mainly couples through the gaps of SRRs, while the magnetic field couples through the circumference [1]. In this work we will focus on the near field inductive coupling in metamaterials. The first problem we have studied the effect of displacements between the resonators inside the unit cell of planar coupled metamaterials. The metamolecule design consists of two planar split- ring resonators (SRRs) which are coupled through the near fields. The numerically simulated transmission spectrum demonstrated split resonances due to the resonance mode hybridization effect. With increase in displacement between the near fields coupled SRRs, this metamaterial system shows a transition from coupled to uncoupled state through merging of the split resonances to the single intrinsic resonance [2]. In another problem we have discussed the near field coupling between the pair of split ring resonators (SRRs) in broadside coupled configuration. The metamaterial design is comprised of two orthogonally twisted broadside coupled SRRs separated by a thin micro-scale polyimide layer (Fig. 1(a)). We analyze the interaction between the meta-layers numerically and analytically by displacing resonators w.r.t. each other. In this system too we have observed split resonances along with frequency tuning of resonances caused by the mode hybridization (Fig. 1(b)) [3]. Such ability to tune resonances should be significant in the development of frequency agile THz devices along with other applications.

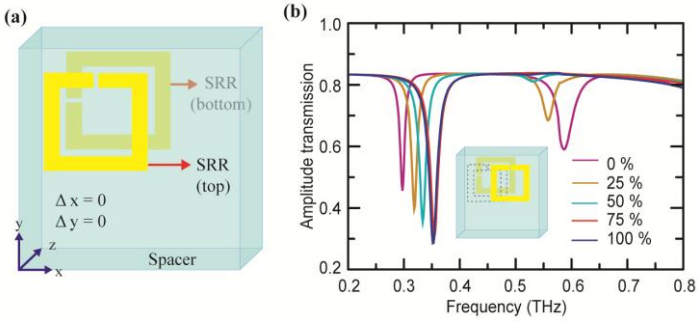

Fig. 1 (a) Represents schematic of unit cell consisting of two SRRs in coupled bilayer THz metamaterials.
(b) Numerically calculated THz amplitude transmission through the coupled metamaterials.

References:

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