Rotationally Reconfigurable Metamaterials for Spatial Light Modulators

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Exploiting moiré interference, we make a new type of reconfigurable metamaterials and study their transmission tunability for incident electromagnetic waves[1]. The moiré pattern is formed by overlapping two transparent layers, each of which has a periodic metallic pattern, and the cluster size of the resulting moiré pattern can be varied by changing the relative superposition angle of the two layers. In our reconfigurable metamaterials, both the size and structural shape of the unit cell can be varied simultaneously through moiré interference. The transmission of electromagnetic waves can be controlled from 90% to 10% about 10 GHz by experiments and numerical simulation. The reconfigurable metamaterials proposed here can be applied in various tunable EM filters and modulation devices. One of the interesting applications is a random spatial light modulator. Utilizing the rotationally reconfigurable metamaterial concept, we suggest a random spatial light modulator composed of two metamaterial layers. The front layer is a normal metamateria layer with a periodic metallic pattern and the other layer is a metamterial array with randomly oriented metamaterials tiles. The device can be worked by rotation of the front layer since the transmission of the metamaterials is very sensitive to the superposition angle between the front layer orientation and direction of each metamaterials tiles. The proposed random spatial light modulator can be used to enhance the performance of high-frequency imaging systems.[2-3]

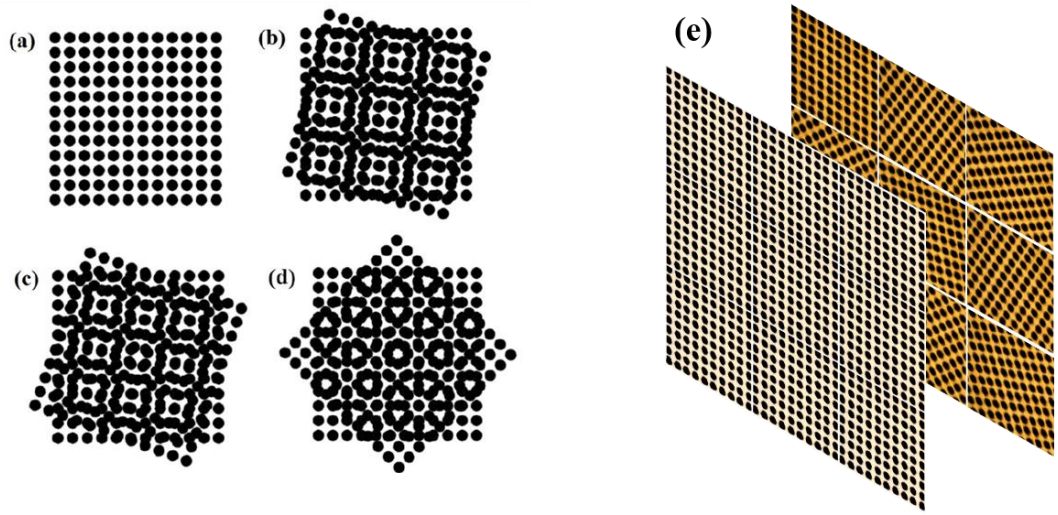

Fig. 1. Schematic view of two-layer superposition with periodic structure of metallic disks (radius of the disk: 1.2mm, unit cell: 3mm) for various rotation angles: (a) θ = 0°, (b) θ = 15°, (c) θ = 20° (d) θ = 45° and (e) the proposed random spatial light modulator utilizing the moiré reconfigurable metamaterials

References

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