A THz Dynamic Switch with MEMS Metamaterial Method

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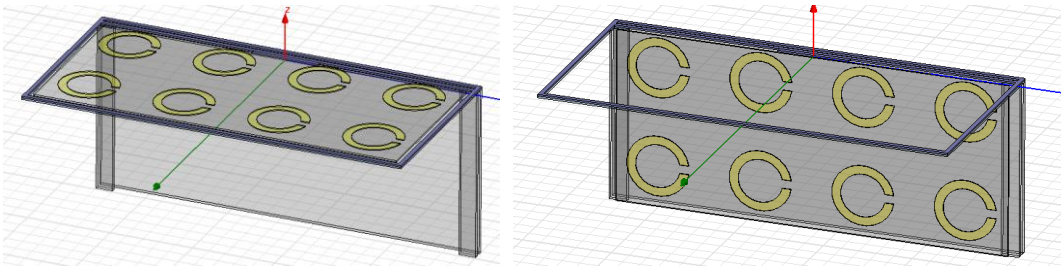
A terahertz (THz) dynamic switch with polarization dependence is proposed with MEMS metamaterial method. The split ring resonators (SRRs) are located on a silicon-on-insulator (SOI) wafer, where the buried oxide (BOX) is etched to let the silicon layer together with the SRRs work as a shutter to control the incident THz wave propagation. Electrostatic actuation is employed for the shutter operation.

The electromagnetic THz wave (0.1 THz – 10 THz) has unique fingerprint properties and leads to potential applications such as the security check, manufacture quality control, molecule identification, and THz high-speed communication. However, effective THz wave devices are few due to the weak interaction of THz wave with natural materials. Metamaterial has shown its potential to build THz devices, such as filter, polarizer, modulator, absorber, wave plate, phase control, and spatial light modulator. Some are even with dynamic control performance.

In this abstract, we propose a novel THz dynamic switch as shown in Fig.1. The SRRs are located on the silicon layer of an SOI wafer. By etching the box and patterning the device layer, it forms a shutter with open- and close-status available with voltage control. Since the electromagnetic feature of the SRRs, the device is able to control the THz wave transmittance with polarization dependence. HFSS (High Frequency Structure Simulator) is used for S-parameter and electric field distribution simulation under the periodic boundary condition. Since the shutter size has no significant relation with the SRR size, the proposal of this design is expected to cover a wide range of frequency from sub-THz to few THz for THz dynamic switch.



(a) shutter close-status (b) shutter open-status

Fig. 1 THz switch with MEMS metamaterial.

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Reference:

[1] Z. Han, K. Kohno, H. Fujita, K. Hirakawa, and H. Toshiyoshi, "MEMS reconfigurable metamaterial for terahertz switchable filter and modulator," *Optics Express*, vol. 22, issue 18, pp. 21326-21339, Sept. 2014.

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