Frequency-controlled metasurface focusing

Huan Lu(1), Rongrong Zhu(2), Tong Cai(1), Bin Zheng(1), Hongsheng Chen(1)
(1) The Electromagnetics Academy at Zhejiang University, Zhejiang University, Hangzhou 310027, China;
email: luhuan123@zju.edu.cn; caitong326@sina.cn; zhengbin@zju.edu.cn; hansomchen@zju.edu.cn
(2) School of Information & Electrical Engineering, Zhejiang University City College, Hangzhou 310015, China; email: rorozhu@zju.edu.cn

A fair amount of theoretical work has shown that frequency-controlled metasurfaces play an important role in contemporary science and technology. However, the wave front manipulation capability of reflected metasurface is still challenging in broadband on account for the dispersion of the phase accumulated by electromagnetic wave propagation [1, 2]. Here, we propose a reflected metasurface based on the principle of dispersion to simultaneously split and focus the incident wave into different energy ranges by a multi-resonant model. We show that the position of focusing can be controlled by tunneling appropriately in designing every unit cell. As a proof of concept, a microwave metasurface within 8~12GHZ is designed and simulated. It is able to control the position of focal spots with different wavelength by achromatic and reflective characteristics. The proposed metasurface opens a door to realize wavefront manipulation in broadband, and chromatically corrected imaging systems.

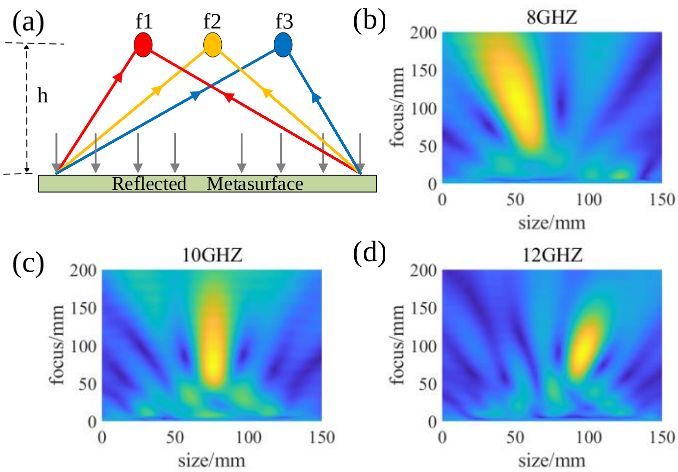

Figure 1. A schematic of the reflected metasurface for frequency-controlled tunable focusing and simulation results of CST.

Figure 1(a) shows the schematic diagram of the proposed metasurface, comprising multi-resonant unit cells. Focus positions of CST simulation after frequency splitting are shown in Figure 1(b)~(d). The results show that the position of the focus after simulation is close to the theoretical focus.

To summarize, we have showed the reflected metasurface for frequency-controlled tunable focusing. As an example, a reflected metasurface with splitting and focusing 8~12GHZ incident wave into different energy ranges is designed and verified. Our method opens the door to control dispersion in multifunctional metasurfaces for applications such as chromatically corrected imaging systems.

References

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