Transmission properties of self-complementary metamaterials via Babinet principle

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Babinet principle is a modern tool for light controlling and widely used in electrodynamics [1]. Here we demonstrate a novel type of Babinet principle based metamaterials exhibiting broadband transmission of asolute amplitude in microwave frequency range. Another feature of the given structure is the simplicity of the unit cell representing a checkerboard-like pattern that simplifies both analysis and fabrication stage.

The well-known Babinet principle here is exploited in the form of two similar metasurfaces (i.e. surfaces whose unit cells are of subwavelength dimension) outstanding from each other at half wavelength distance and providing complementary patterns (see Fig. 1(a)) [2]. The simulated transmission characteristics have demonstrated the absolute transmission at the region of 5-6.5 GHz corresponding to ultra-broadband transmission. Furthermore, experimental measurement in an anechoic chamber of metamaterial sample perfectly matched the theoretical one and confirmed ultra-broadband transmission at 4.5-6.5 GHz frequencies (Fig. 1(b)).

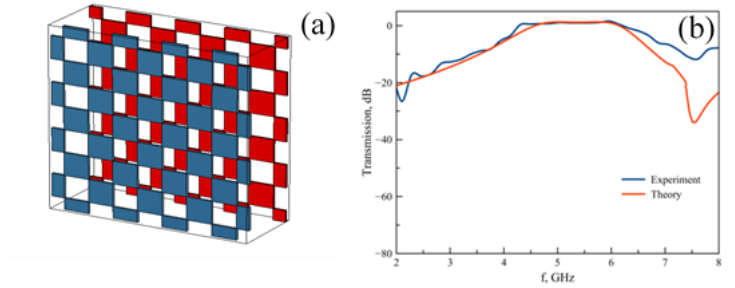

Fig. 1. :Illustration of Babinet metamaterial (a) and its simulated and measured transmission characteristics (b).Poincare sphere

Given results are of great interest of modern technologies, since this ability of light manipulation able to provide number of applications, namely, they could serve as frequency selective surfaces, polarizers, filter design and broadband transparent screens for different spectra ranges.

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4. References

[1] M. Babinet, “Memoires d'optique météorologique,” *Acad. Sci., Paris*, C. R. 4, pp. 638–648, 1837
[2] Yoshiro Urade, Yosuke Nakata, Toshihiro Nakanishi, and Masao Kitano, “Frequency-Independent Response of Self-Complementary Checkerboard Screens,” Physical Review Letters 114, pp. 237401, 2015

(a)