

Analysis of wave properties in photonic crystal narrowband filters with  
left-handed defect

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Abstract

Optical wave properties for a photonic crystal narrowband filter with a left-handed defect are theoretically investigated. The filter is made of a defect layer together with two quarter-wave dielectric photonic crystals in a symmetric manner. It is found that a narrowband transmission filter can be achieved with the value of negative refractive index in defect being an even interger when the defect thickness equals the quarter wavelength. It also can be implemented when the value of negative refractive index equal to an interger if the defect thickness is taken to be the half-wavelength. As for the asymmetric one, there is only one selection rule for the quarter wavelength defect. Additionally, the effects of losses coming from the left-handed defect are also examined. The results establish guiding rules for the choice of negative refractive index that are of technical use in designing such a filter with a left-handed defect.

Keyword : photonic crystal, narrowband filter, left-handed defect