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CALCULATION OF TRANSMISSION SPECTRA OF APERIODIC PHOTONIC CRYSTALS

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Abstract: In recent years, photonic quasicrystals (PQs) with aperiodic structures have attracted many interests for their amusing photonic band gap (PBG) properties analogical to those of periodic photonic crystals. The diversity of the PBGs of PQs is magnetic both theoretically and experimentally for potential applications in novel optical and optoelectronic devices. Among various PQs, the properties of one-dimensional PQs could be simulated more precisely. One-dimensional PQs, including Fibonacci and Thue- Morse (TM) sequences have been constructed experimentally. Here, the transmission spectra of aperiodic photonic crystals are calculated by transfer matrix method in order to discuss the PBG.

Keywords and Phrases: Transmission spectra, aperiodic photonic crystals, transfer matrix method.

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1. Introduction

There is currently a great interest in the physics and applications of one-dimensional spatially periodic, quasiperiodic and random photonic bandgap (PBG) structures [1, 2]. Quasi-crystals can be considered as suitable models to describe the transition from the perfect periodic structure [3] to the random structure [4, 5]. PQs can be generated by stacking together layers of different dielectric materials according to a simple deterministic generation rule [6]. Thue-Morse structure [7], Fibonacci sequence [8-10], Cantor layer etc. are some examples of the one dimensional quasiperiodic structures.

Quasicrystals represent an intermediate organization stage between periodic dielectric materials and random media and have fascinating properties like the formation of multiple frequency band gap regions, transmission resonances and the occurrence of critically localized states.