Abstract Submitted
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**Multi-layered photonic crystals *de novo*: new formalism, results, insights, and analytic possibilities**[1] FRANK SZMULOWICZ, University of Dayton Research Institute — A new formalism for calculating the photonic band structure of multi-layer photonic gap (PBG) materials is derived. The formalism expresses all boundary conditions in terms of tangents rather than exponential functions. The formalism is compact, algorithmically simple, and physically appealing, and provides a new conceptual framework for describing the photonic band structure of layered materials. Its simplicity makes it possible to represent eigenfrequency conditions using geometric constructs, find a factored form of the secular equation, and derive analytic eigenfrequency conditions and analytic wave functions for multi-layer structures. Computationally, the new formalism makes it possible to find explicitly the complete band structure of multi-layer PBG materials with integer ratios of optical path lengths (e.g., any combination of quarter-wave, half-wave, etc., stacks) through a single diagonalization of a low order secular equation, the alternative being an implicit root search via the transfer matrix formalism. The formalism is demonstrated on multi-layered structures arranged in the Fibonacci sequence and half-wave-quarter-wave-eighth-wave PBG.

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