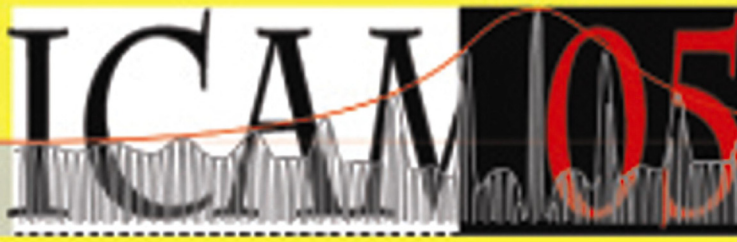

Proceedings of International Conference on Applied Mathematics 2005

22-26 AUGUST 2005
AULA TIMUR
ITB BANDUNG INDONESIA

ISBN: 90-365-2244-7

Band Structure Design Of A Finite 1D Optical Grating

A. Iskandar[1], W. Yonan[1], M. O. Tjia[1], I. van de Voorde[2], E. van Groesen[2]

[1)] Department of Physics, Institut Teknologi Bandung, Indonesia
[2)] University of Twente, The Netherlands

Abstract: A finite one-dimensional optical grating with possible tailoring of its transmission characteristics can serve as a functional building block for various optical devices ranging from filters (pass filter and stop filters), Distributed Bragg Reflectors (DBR), Wavelength Division Multiplexing (WDM) filters, and optical sensors. Two basic requirements to be met in such a system are optimal transmittance achieved in the bandpass region and a good quality bandgap at the band stop region.

In order to meet the first requirement above, a commonly adopted approach is to use the Anti Reflection Coating (ARC) in the front and the back of the original grating. The use of this coating is to give extra parameters that can be tuned to produce the desired response. With this coating, the geometrical parameters of the ARC is optimized without changing the physical and geometrical parameters of the original grating. While for the second requirement, one resort to either designing the grating structure with a large number of unit cells or a large index contrast between the dielectric layers in an unit cell.

In this work, we present a structured and simplified method to formulate a 1D multilayer system or grating as a bulk effective medium. In this effective formulation, a frequency dependent effective boundary condition is shown to determine the envelope function of the transmittance curve. Using this function, the optimization of the transmittance curve in a certain passband can be achieved without adding extra ARC layers. Furthermore, through this formulation, we find the minimum requirement of the index contrast for achieving a good bandgap.

Keywords: Multilayer System, Transfer Matrix, Band Structure