ANALYSIS OF METAL-CLAD TM-PASS POLARIZERS USING THE METHOD OF LINES

by

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Dedicated

to

my beloved mother

and

to the memory of my late father.

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Nomenclature

English Symbols

$\mathbf{E}$	electric field vector, volts/meter
$\mathbf{H}$	magnetic field vector, amperes/meter
N	diagonal matrix of refractive-index squared at mesh grids
I	identity matrix
B	Phase Parameter
P	time-averaged power per unit length in the y-direction, watts/m
Q	matrix of the eigen-value equation
n	refractive index
k_o	free space wavenumber, radians/meter
h	mesh size, meter
d	thickness of a layer, meter
b	buffer layer thickness, meter
L	length of metal-clad section, meter

L_{gr}	length of grating section in the polarizer, meter
L_S	spacing between metal-clad and grating section, meter
j	$\sqrt{-1}$
t	time, sec
$\mathbf{A} \cdot \mathbf{B}$	scalar (dot) product of vectors **A** and **B**
$\mathbf{A} \times \mathbf{B}$	vector (cross) product of vectors **A** and **B**

Greek Symbols

ψ	general field component of the **E** or **H** field
Ψ	general field component of the **E** or **H** sampled field, column vector
ϵ_o	free space permittivity, $4\pi \cdot 10^{-7}$ Vs/Am
ϵ_r	relative permittivity
μ_o	free space permeability, $8.8541 \cdot 10^{-12}$ As/Vm
μ_r	relative permeability
$\omega = 2\pi f$	angular frequency, rad/sec
α_m	mth modal field coefficient
β	propagation constant. radians/meter
λ	wavelength, meter
∇	nabla operator, $\frac{\partial}{\partial x}\hat{a_x} + \frac{\partial}{\partial y}\hat{a_y} + \frac{\partial}{\partial z}\hat{a_z}$
∇^2	Laplace operator, $\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$

Abbreviations

TE	Transverse Electric

TM	Transverse Magnetic
MOL	Method of Lines
PML	Perfectly Matched Layer
BPM	Beam Propagation Method
ABC	Absorbing Boundary Condition
PER	Polarizer Extinction Ratio
PIL	Polarizer Insertion Loss
FOM	Polarizer Figure of Merit
n_{eff}	Modal Effective Index
λ_B	Bragg Wavelength
Re	Real part of a complex number
Im	Imaginary part of a complex number

Subscripts

A_x, A_y, A_z	x, y, z components of a vector $\mathbf{A}$
$\psi_0, \psi_{\pm 1}, \psi_{\pm 2}$	sample number of field ψ
$\psi_{0\pm}, \psi_{1\pm}, \psi_{2\pm}$	field immediately to the left or to the right of a sample point

Superscript

ψ'	first derivative of ψ
ψ''	second derivative of ψ
ψ'''	third derivative of ψ

ψ''''	fourth derivative of ψ
ψ'''''	fifth derivative of ψ
ψ''''''	sixth derivative of ψ
β''	mode attenuation, N_p/μm
${n_{eff}}'$	real part of the effective index
${n_{eff}}''$	imaginary part of the effective index
A^*	complex conjugate of A