JOSA COMMUNICATIONS

Communications are short papers. Appropriate material for this section includes reports of incidental research results, comments on papers previously published, and short descriptions of theoretical and experimental techniques. Communications are handled much the same as regular papers. Proofs are provided.

Dispersion in photonic media and diffraction from gratings: a different modal expansion for the R-matrix propagation technique: comment

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In a recent paper by Elson and Tran [J. Opt. Soc. Am. A **12**, 1765 (1995)], numerical results are given and compared with those obtained by Li [J. Opt. Soc. Am. A **10**, 2581 (1993)]. Some strong discrepancies appear in these comparisons, especially in TM polarization. Accurate and reliable data are given to clarify this disagreement. © 1996 Optical Society of America.

In a recent paper by Elson and Tran,[1] numerical results are given and compared with those obtained by Li.[2] Some strong discrepancies are found, especially in TM polarization. The strongest discrepancies are found in Table 2 of Ref. 1. In this case the grating profile is sinusoidal, with a complex dielectric constant $\epsilon = (-48.91, 4.2)$, angle of incidence 30°, and period over wavelength ratio $d/\lambda = 1.7$. Because the grating structure is quite simple, several algorithms are able to give reliable results when the grating depth is not too large ($h/d = 0.1$ or $h/d = 1$). The method of fictitious sources[3] (MFS) was used to compute the grating efficiencies given in this comment. The efficiencies were carefully checked by convergence tests and also by comparisons with an integral method[4] (IM). Consequently, I can affirm that all the digits given in Table 1 here for the MFS and for the IM are correct. Clearly, the results given in Ref. 1 are not accurate, especially for TM polarization when the groove depth increases. The authors of Ref. 1 seem to imply that Li's results are uncertain; they write, "Li stated that as the number of diffracted orders or sublayers is changed, his numerical results fluctuate" (p. 1768). But they do not report about convergence tests for their own calculations. Indeed, several reasons can explain the discrepancies between the results. First, it is likely that the structure is not sufficiently well represented by only ten sublayers when $h/d = 1$. Second, it is well known that in the TM polarization case, the convergence of the solution versus the number of terms in the modal expansion is slow, and perhaps 105 modes are not enough.

It is also worth checking to see that there is no anomaly in the vicinity of the parameters studied in Table 1 (such an anomaly could give fast variations of the efficiencies and explain that the results are more difficult to com-

Table 1. Complement to Table 2 of Ref. 1[a]

Order	$h/d = 0.1$			$h/d = 1$		
	Elson and Tran	Li	MFS or IM	Elson and Tran	Li	MFS or IM
TE polarization						
R_{-2}	0.0116	0.0116	0.0116	0.4152	0.4135	0.423
R_{-1}	0.2066	0.2067	0.2064	0.3338	0.3353	0.330
R_0	0.7604	0.7602	0.7608	0.2010	0.2018	0.199
TM polarization						
R_{-2}	0.0258	0.0279	0.0270	0.0274	0.1264	0.197
R_{-1}	0.2564	0.2784	0.2765	0.0664	0.0603	0.086
R_0	0.6131	0.6519	0.6604	0.2146	0.6609	0.595

[a] Strongest discrepancies appear for $h/d = 1$ and TM polarization.

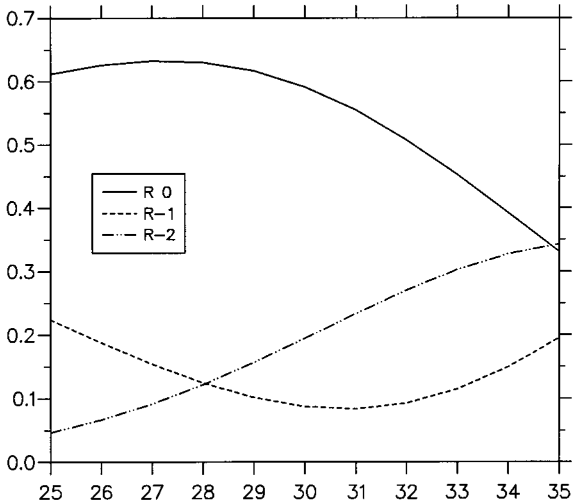

Fig. 1. Reflected efficiencies versus incidence angle. Same sinusoidal grating as in Table 1, with $h/d = 1$, TM polarization.

pare). For this purpose, I give in Fig. 1 the efficiencies for an angle of incidence in the range 25°–35°. It appears that the curves are very smooth.

In conclusion, the recursive algorithms appear to be, at the present time, one of the most promising ways to solve very-deep-gratings problems ($h/d = 10$ or more). But their reliability should at least be established in the easier cases in which they can be compared with other methods, and I suggest to Elson and Tran that they increase the number of diffracted orders and the number of sublayers in order to find out whether their results converge toward the correct results without numerical problems.

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