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金属光栅的矢量模态理论*

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提 要

采用矢量模式场展开的方法来研究任意槽形金属光栅对矢量波的衍射效率.当线偏振光在光栅主截面内入射时,其结果与已报道的相同.

关键词 光栅, 矢量模态理论.

1 引 言

J. R. Fox 和 J. R. Andrewartha[1,2] 等人曾建立了金属光栅的模态理论,但是这种理论仅能处理光栅对在光栅主截面内线偏振入射光的衍射问题.如要处理金属光栅或者周期性金属物体对不在主截面内入射、任意偏振态矢量波的衍射问题,就必须建立相应的矢量模态理论.

W. W. Hansen 曾提出解均匀矢量亥姆霍兹方程$\nabla^2\boldsymbol{F}+k^2\boldsymbol{F}=0$的方法并提出:

1) 先解与上述均匀矢量亥氏方程相对应的标量亥氏方程$(\nabla^2+k^2)\Psi=0$,将其解称为生成函数Ψ.

2) 选择任意一个常矢量$\boldsymbol{a}$作为领示矢量就可以构成一组矢量波函数$\boldsymbol{L}$、$\boldsymbol{M}$、$\boldsymbol{N}$.其中$\boldsymbol{L}=\nabla\Psi,\boldsymbol{M}=\nabla\times(\boldsymbol{a},\Psi),\boldsymbol{N}=k^{-1}\nabla\times\boldsymbol{M}$.该组矢量波函数都满足均匀矢量亥姆霍兹方程.

3) 以$\boldsymbol{L}$、$\boldsymbol{M}$、$\boldsymbol{N}$为矢量基矢将$\boldsymbol{F}$展开.

把上述方法运用到光栅衍射问题上本文采取的方法是:

1) 先解相应的标量亥姆霍兹方程得到生成函数Ψ.

2) 根据 Morse-Feshbach 判据[8]选择合适的坐标轴单位矢量为领示矢量来构成符合具体边界条件的标准矢量基矢波函数$\boldsymbol{L}_m,\boldsymbol{M}_m,\boldsymbol{N}_m$.因光栅问题属于无源问题,$\boldsymbol{L}_m=0$.

3) 将光栅划分为槽内区与槽外区,将槽内的模式场与槽内的入射场和衍射场分别以相应的标准矢量基矢波函数展开.然后通过在槽内,外分界面上的场匹配条件得到一组振幅系数方程组,解出振幅系数就可获得衍射效率,偏振态和"反常现象".

2 矢量基矢函数的建立与场的展开

如图1所示,建立直角坐标系,d是光栅周期.设光栅在x和z方向都是无限长,且为良导体,对外场无吸收.据 Moarse-Feshbach 判据[8],在直角坐标系中,任取某一坐标轴单位矢量x_0、y_0、z_0为领示矢量,都可构成一组标准矢量基矢波函数.在本文一律取z_0为领示矢量.将光栅划

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分为槽内、外两个区域.

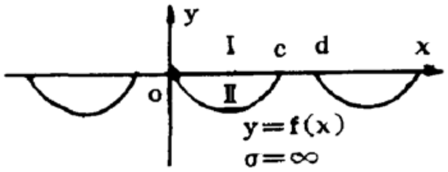

Fig. 1 Geometry for the perfectly conducting reflection grating

I　区域：显然，可取入射波的生成函数为平面波函数

$$\Psi^I = \exp[i(k_x x - k_y y + k_z z)], \tag{1}$$

其中 $k^2 = (\frac{2\pi}{\lambda})^2 = k_x^2 + k_y^2 + k_z^2 = (k^{\mathrm{I}})^2 + k_z^2$，$\lambda$ 是波长 (2)

$$k_x = k^{\mathrm{I}}\sin\theta, \quad k_y = k^{\mathrm{I}}\cos\theta. \tag{3}$$

$$\begin{cases} \boldsymbol{M}_i^I = \nabla \times (\boldsymbol{z}_0 \Psi^I) = (-\frac{i}{k^{\mathrm{I}}})(k_y \boldsymbol{x}_0 + k_x \boldsymbol{y}_0)\exp[i(k_x x - k_y y + k_z z)], & (4) \\ \boldsymbol{N}_i^I = \frac{1}{k}\nabla \times \boldsymbol{M}_i^I = \frac{1}{kk^{\mathrm{I}}}[-k_x k_z \boldsymbol{x}_0 + k_y k_z \boldsymbol{y}_0 + (k^2 - k_z^2)\boldsymbol{z}_0]\exp[i(k_x x - k_y y + k_z z)] & (5) \end{cases}$$

入射矢量平面波可以 $\{\mathbf{M}_i^I, \mathbf{N}_i^I\}$ 为基矢展开.

$$\boldsymbol{E}_i^I = -(A\boldsymbol{M}_i^I + B_i \boldsymbol{N}^I), \tag{6}$$

$$\boldsymbol{H}_i^I = -i\sqrt{\frac{\varepsilon}{\mu}}(A_i \boldsymbol{N}_i^I + B_i \boldsymbol{M}_i^I). \tag{7}$$

同理衍射波的生成函数取准平面波函数

$$\Psi_n^I = \exp[i(k_{x,n}x + k_{y,n}y + k_z z)], \tag{8}$$

其中

$$k_{x,n} = k_x + \frac{2n\pi}{d} \qquad n = 0, \pm 1, \pm 2\cdots \tag{9}$$

$$k_y{}^2,n = k^2 - k_x{}^2,n - k_z^2. \tag{10}$$

当 $k_{y,n}$ 取实数时，衍射场是传播场，当 $k_{y,n}$ 取虚数时衍射场是消逝场.

$$\boldsymbol{M}_n^I = \nabla \times (\boldsymbol{z}_0 \Psi_n^I) = \frac{i}{k^{\mathrm{I}}}(k_{y,n}\boldsymbol{x}_0 - k_{x,n}\boldsymbol{y}_0)\exp[i(k_{x,n}x + k_{y,n}y + k_z z)], \tag{11}$$

$$\boldsymbol{N}_n^I = \frac{1}{k}\nabla \times \boldsymbol{M}_n^I = \frac{1}{kk^{\mathrm{I}}}[-k_{x,n}k_z \boldsymbol{x}_0 - \boldsymbol{k}_{y,n}\boldsymbol{k}_z \boldsymbol{y}_0 + (k^2 - k_z^2)\boldsymbol{z}_0]\exp[i(k_{x,n}x + k_{y,n}y + k_z z)]. \tag{12}$$

$$\boldsymbol{E}_n^I = -\sum_n (A_n \boldsymbol{M}_n^I + B_n \boldsymbol{N}_n^I), \tag{13}$$

$$\boldsymbol{H}_n^I = -i\sqrt{\frac{\varepsilon}{\mu}}(A_n \boldsymbol{N}_n^I + B_n \boldsymbol{M}_n^I). \tag{14}$$

II　区域：由于金属导体表面上的电场矢量和磁场矢量分别必须满足 Dirichlet，Neumann 边界条件，即 $\boldsymbol{n}\times\begin{Bmatrix}\boldsymbol{M}_e^{\mathrm{II}}\\ \boldsymbol{N}_e^{\mathrm{II}}\end{Bmatrix}_s = 0$，$\boldsymbol{n}\times\nabla\times\begin{Bmatrix}\boldsymbol{M}_m^{\mathrm{II}}\\ \boldsymbol{N}_m^{\mathrm{II}}\end{Bmatrix}_s = 0$，$\boldsymbol{n}$ 代表表面法线矢量，S 代表表面形状，故经尝试推导后选取两组基本实函数：

$$\Psi_{mp}^{eo} = \cos\frac{p\pi x}{c}\frac{\sin\mu_p y}{\mu_p}\exp(ik_z z), \qquad p = 0, \pm 1, \pm 2, \cdots \tag{15}$$

$$\Psi_{mp}^{oo} = \sin\frac{p\pi x}{c}\frac{\sin\mu_p y}{\mu_p}\exp(ik_z z), \quad m = 1,2,\cdots \tag{16}$$

$$\mu_p^2 = k^2 - k_z^2 - (\frac{p\pi}{c})^2 \quad \mu_p \text{ 取正实数} \tag{17}$$

将相应的标量生成函数定义为 $\varphi_{mp} = \frac{\partial\Psi_{mp}}{\partial y} + \beta_m\Psi_{mp}$，显然 φ_{mp} 满足 $(\nabla^2 + k^2)\varphi_{mp} = 0$. 则：

$$
\left.\begin{aligned}
\varphi_{mp}^{eo} &= \cos\frac{p\pi x}{c}\left(\cos\mu_p y + \frac{\beta_m^{eo}}{\mu_p}\sin\mu_p y\right)\exp(ik_z z), \\
\varphi_{mp}^{oo} &= \sin\frac{p\pi x}{c}\left(\cos\mu_p y + \frac{\beta_m^{oo}}{\mu_p}\sin\mu_p y\right)\exp(ik_z z).
\end{aligned}\right\} \tag{18}
$$

显见 $\varphi_{mp}^{eo}, \varphi_{mp}^{oo}$ 也满足在 $y=0$ 处阻抗条件 $\frac{\partial\Phi_{mp}}{\partial y}\big|_{y=0}=\beta_m\Phi_{mp}\big|_{y=0}=0$ $(0\leqslant x\leqslant c)$，$\beta_m^{eo}$，$\beta_m^{oo}$ 是实本征值.

从(18)式得到一组电场，磁场基矢波函数：

$$
\left.\begin{aligned}
\boldsymbol{M}_{mp}^{eo} &= \exp(ik_z z)\left[-\mu_p\cos\frac{p\pi x}{c}\left(\sin\mu_p y - \frac{\beta_m^{eo}}{\mu_p}\cos\mu_p y\right)\boldsymbol{x}_0 + \left(\frac{p\pi}{c}\right)\sin\frac{p\pi x}{c}\left(\cos\mu_p y + \frac{\beta_m^{eo}}{\mu_p}\sin\mu_p y\right)\boldsymbol{y}_0\right], \\
\boldsymbol{N}_{mp}^{oo} &= \frac{1}{k}\exp(ik_z z)\left[(ik_z)\left(\frac{p\pi}{c}\right)\cos\frac{p\pi x}{c}\left(\cos\mu_p y + \frac{\beta_m^{oo}}{\mu_p}\sin\mu_p y\right)\boldsymbol{x}_0 - (ik_z)\mu_p\sin\frac{p\pi x}{c}\left(\sin\mu_p y - \right.\right. \\
&\left.\left.\frac{\beta_m^{oo}}{\mu_p}\cos\mu_p y\right)\boldsymbol{y}_0 + (k^2-k_z^2)\sin\frac{p\pi x}{c}\left(\cos\mu_p y + \frac{\beta_m^{oo}}{\mu_p}\sin\mu_p y\right)\boldsymbol{z}_0\right].
\end{aligned}\right\} \tag{19}
$$

$$
\left.\begin{aligned}
\boldsymbol{N}_{mp}^{eo} &= \frac{1}{k}\exp(ik_z z)\left[(-ik_z)\left(\frac{p\pi}{c}\right)\sin\frac{p\pi x}{c}\left(\cos\mu_p y + \frac{\beta_m^{eo}}{\mu_p}\sin\mu_p y\right)\boldsymbol{x}_0 - (ik_z)\mu_p\cos\frac{p\pi x}{c}\times\left(\sin\mu_p y - \right.\right. \\
&\left.\left.\frac{\beta_m^{eo}}{\mu_p}\cos\mu_p y\right)\boldsymbol{y}_0 + (k^2-k_z^2)\cos\frac{p\pi x}{c}\left(\cos\mu_p y + \frac{\beta_m^{eo}}{\mu_p}\sin\mu_p y\right)\boldsymbol{z}_0\right], \\
\boldsymbol{M}_{mp}^{oo} &= \exp(ik_z z)\left[-\mu_p\sin\frac{p\pi x}{c}\left(\sin\mu_p y - \frac{\beta_m^{eo}}{\mu_p}\cos\mu_p y\right)\boldsymbol{x}_0 - \left(\frac{p\pi}{c}\right)\cos\frac{p\pi x}{c}\left(\cos\mu_p y + \frac{\beta_m^{eo}}{\mu_p}\sin\mu_p y\right)\boldsymbol{y}_0\right]
\end{aligned}\right\} \tag{20}
$$

将 I 区的电场、磁场分别展开：

$$
\boldsymbol{E}^{\mathrm{I}} = -\sum_m(a_m\boldsymbol{M}_m^{eo} + b_m\boldsymbol{N}_m^{oo}) = -\sum_m\left[a_m\sum_p g_{mp}^{eo}\boldsymbol{M}_{mp}^{eo} + b_m\sum_p g_{mp}^{oo}\boldsymbol{N}_{mp}^{oo}\right], \tag{21}
$$

$$
\boldsymbol{H}^{\mathrm{I}} = -i\sqrt{\frac{\varepsilon}{\mu}}\sum_m(a_m\boldsymbol{N}_m^{eo} + b_m\boldsymbol{M}_m^{oo}) = -i\sqrt{\frac{\varepsilon}{\mu}}\sum_m\left[a_m\sum_p g_{mp}^{eo}\boldsymbol{N}_{mp}^{eo} + b_m\sum_p g_{mp}^{oo}\boldsymbol{M}_{mp}^{oo}\right], \tag{22}
$$

由边界条件 $\boldsymbol{n}_{(n_x,n_y,0)}\times\boldsymbol{E}^{\mathrm{I}}\big|_{y=f(x)}=0$，可得两个本征方程

$$
\sum_p g_{mp}^{oo}\sin\frac{p\pi x}{c}\left(\cos\mu_p y + \frac{\beta_m^{oo}}{\mu_p}\sin\mu_p y\right)\Big|_{y=f(x)} = 0, \tag{23}
$$

$$
\sum_p g_{mp}^{eo}\left[f'(x)\left(\frac{p\pi}{c}\right)\sin\frac{p\pi x}{c}\left(\cos\mu_p y + \frac{\beta_m^{eo}}{\mu_p}\sin\mu_p y\right) - \mu_p\cos\frac{p\pi x}{c}\left(\sin\mu_p y - \frac{\beta_m^{eo}}{\mu_p}\cos\mu_p y\right)\right]\Big|_{y=f(x)} = 0. \tag{24}
$$

对(23)，(24)进行傅里叶展开得

$$
\left\{\begin{aligned}
G_{qp}^{oo} &= \frac{1}{c}\int_0^c\cos[\mu_p f(x)]\sin\frac{p\pi x}{c}\sin\frac{q\pi x}{c}dx, \\
H_{qp}^{oo} &= \frac{1}{c}\int_0^c\frac{\sin[\mu_p f(x)]}{\mu_p}\sin\frac{p\pi x}{c}\sin\frac{q\pi x}{c}dx.
\end{aligned}\right.\quad q=1,2\cdots \tag{25}
$$

$$
\left\{\begin{aligned}
G_{qp}^{eo} &= \frac{1}{c}\int_0^c\left\{\left(\frac{p\pi}{c}\right)f'(x)\sin\frac{p\pi x}{c}\cos[\mu_p f(x)] - \mu_p\cos\frac{p\pi x}{c}\sin[\mu_p f(x)]\right\}\cos\frac{q\pi x}{c}dx, \\
H_{qp}^{eo} &= \frac{1}{c}\int_0^c\left\{\left(\frac{p\pi}{c}\right)f'(x)\sin\frac{p\pi x}{c}\frac{\sin[\mu_p f(x)]}{\mu_p}\cos\frac{p\pi x}{c}\cos[\mu_p f(x)]\right\} + \cos\frac{q\pi x}{c}dx.
\end{aligned}\right. \tag{26}
$$

这样(23)，(24)式都变成 $(G+\beta H)g=0$ 形式，经适当截断后可得本征值 β^{oo}_{eo}，本征矢 g^{oo}_{eo}.

3　在 $y=0$ 处场的匹配

在槽内、外分界面 $y=0$ 处，场矢量必须满足场匹配条件：

$$y_0 \times E^{\text{I}} = y_0 \times (E_i \times E_n), \quad y_0 \times H^{\text{I}} = y_0 \times (H_i + H_n) \tag{27}$$

由(27)式可以得到振幅系数方程组：

$$\frac{B_i}{k^{\text{I}}} e^{ik_x x} + \sum_n \frac{B_n}{k^{\text{I}}} e^{ik_{x,n} x} = \sum_m b_m \left(\sum_p g_{mp}^{oo} \sin \frac{p\pi x}{c}\right) \tag{28}$$

$$\left[\frac{A_i}{k^{\text{I}}}(ik_y) + \frac{B_i}{k^{\text{I}}}\left(\frac{k_x k_z}{k}\right)\right] e^{ik_x x} + \sum_n \left[\frac{A_n}{k^{\text{I}}}(-ik_{y,n}) + \frac{B_n}{k^{\text{I}}}\left(\frac{k_{x,n} k_z}{k}\right)\right] e^{ik_{x,n} x}$$

$$= -\sum_m \left\{a_m \left(\sum_p g_{mp}^{eo} \beta_m^{eo} \cos \frac{p\pi x}{c}\right) + \left(\frac{ik_z}{k}\right) b_m \left[\sum_p g_{mp}^{oo} \left(\frac{p\pi}{c}\right) \cos \frac{p\pi x}{c}\right]\right\} \tag{29}$$

$$\frac{A_i}{k^{\text{I}}} e^{ik_x x} + \sum_n \frac{A_n}{k^{\text{I}}} e^{ik_{x,n} x} = \sum_m a_m \left(\sum_p g_{mp}^{eo} \cos \frac{p\pi x}{c}\right) \tag{30}$$

$$\left[\frac{A_i}{k^{\text{I}}}\left(\frac{k_x k_z}{k}\right) + \frac{B_i}{k^{\text{I}}}(ik_y)\right] e^{ik_x x} + \sum_n \left[\frac{A_n}{k^{\text{I}}}\left(\frac{k_{x,n} k_z}{k}\right) - \frac{B_n}{k^{\text{I}}}(ik_{y,n})\right] e^{ik_{x,n} x}$$

$$= \sum_m \left\{\left(i\frac{k_z}{k}\right) a_m \left[\sum_p g_{mp}^{eo} \left(\frac{p\pi}{c}\right) \sin \frac{p\pi x}{c}\right] - b_m \left[\sum_p g_{mp}^{oo} \beta_m^{oo} \sin \frac{p\pi x}{c}\right]\right\} \tag{31}$$

设

$$I_{pn}^{0} = \int_o^c \sin \frac{p\pi x}{c} e^{-ik_{x,n} x} dx, \quad I_{pn}^{e} = \int_o^c \cos \frac{p\pi x}{c} e^{-ik_{x,n} x} dx. \tag{32}$$

将(28),(30)两式二边都乘以 $e^{-ik_{x,n} x}$，再从(o～d)积分，将(29),(31)两边分别乘以 $\cos \frac{q\pi x}{c}$, $\sin \frac{q\pi x}{c}$，再从(o～c)积分整理后可得

$$\frac{2A_i}{k^{\text{I}}}(ik_y)\,\overline{I_{qo}^{e}} = \sum_m \left\{a_m \left[\frac{i}{d}\sum_n k_{y,n}\,\overline{I_{qn}^{e}}\left(\sum_p g_{mp}^{eo} I_{pn}^{e}\right) - \varepsilon_q c\left(g_{mq}^{eo} \beta_m^{eo}\right)\right] - b_m \left(\frac{k_z}{k}\right)\left[\frac{1}{d}\sum_n k_{x,n}\,\overline{I_{qn}^{e}}\left(\sum_p g_{mp}^{oo} I_{pn}^{o}\right) + i\varepsilon_q c g_{mq}^{oo}\left(\frac{q\pi}{c}\right)\right]\right\} \tag{33}$$

$$\frac{2B_i}{k^{\text{I}}}(ik_y)\,\overline{I_{qo}^{o}} = \sum_m \left\{a_m \left(\frac{k_z}{k}\right)\left[-\frac{1}{d}\sum_n k_{x,n}\,\overline{I_{qn}^{o}}\left(\sum_n g_{mp}^{eo} I_{pn}^{e}\right) + i\,\frac{c}{2} g_{mq}^{eo}\left(\frac{q\pi}{c}\right)\right] + b_m \left[\frac{1}{d}\sum_n ik_{y,n}\,\overline{I_{qn}^{o}}\left(\sum_p g_{mp}^{oo} I_{pn}^{o}\right) - \frac{c}{2} g_{mq}^{oo} \beta_m^{oo}\right]\right\} \tag{34}$$

当 $k_z = 0$ 时，若将(29)式两边乘以 $e^{-ik_{x,n} x}$，再从(o～d)积分，将(30)式两边乘以 $\cos \frac{q\pi x}{c}$，再从(o～c)积分可得：

$$\frac{2A_i}{k}\,\overline{I_{qo}^{e}} = \sum_m a_m \left[\sum_n \frac{i\overline{I_{qn}^{e}}}{dk_{y,n}}\left(\sum_p g_{mp}^{eo} \beta_m^{eo} I_{pn}^{e}\right) + \varepsilon_q c g_{mq}^{eo}\right] \tag{35}$$

$$\frac{2B_i}{k}(ik_y)\,\overline{I_{qo}^{o}} = \sum_m b_m \left[\frac{i}{d}\sum k_{y,n}\,\overline{I_{qn}^{o}}\sum_p g_{mp}^{oo} I_{pn}^{o}\right) - \frac{c}{2} g_{mq}^{oo} \beta_m^{oo}\right] \tag{36}$$

显见(35)、(36)式分别就是文献[2]中的(35),(36)和(24),(25)式.

上述各式中 $\varepsilon_q = \begin{cases} \frac{1}{2} & q \geqslant 1 \\ 1 & q = 0 \end{cases}$

将(33),(34)式适当截断就可得到<Ⅱ>式模式场展开系数 a_m, b_m，再代入(28～31)式就可解得衍射场的振幅系数 A_n 和 B_n.

4 结　　论

1) 当 $k_{y,n}$ 是实数时，第 n 级衍射波是真实传播的衍射场，其衍射效率为

$$E_{(n)} = \left(\frac{|A_n|^2 + |B_n|^2}{|A_i|^2 + |B_i|^2}\right)\left(\frac{K_{y,n}}{k_y}\right) \tag{37}$$

当 $k_{y,n}$ 为虚数时，第 n 级衍射波是瞬衰场.

2) 振幅系数一般是复数，从 A_n、B_n 之间相位差可求出衍射场的偏振态.

3) 过去国外所采用的模态理论仅能处理光栅对在光栅主截面内入射线偏振光的衍射问题，是一种特殊情况($k_z=0$). 本文采用矢量模态理论解决了光栅对任意矢量场的衍射问题. 国外有文献报导[6]，园偏振光能最有效地抑制光栅高阶能量. 因此采用符合 Morse-Feshbach 判据的标准矢量波函数直接处理光栅或周期性金属物体对矢量入射波的衍射问题有实用价值.

4) 本组曾采用矢量模态理论建立了金属矩形槽光栅和对称型闪耀光栅的矢量模态理论进一步建立了任意槽形金属光栅的矢量模态理论，对上述工作都建立了相应的计算机程序. 其实用例以后发表.

参 考 文 献

[1] J. R. Fox, General modal theory of scalar wave scattering by periodic surfaces. *Opt. Acta*, 1980, **27**(3): 289～305

[2] J. R. Andrewartha, G. H. Derrick, R. C. Mcphedran, A general modal theory for reflection gratings. *Opt. Acta*, 1981, **28**(11): 1501～1516

[3] W. W. Hansen, A new type of expansion in radiation problems. *phys. Rev.*, 1935, **47**(1): 139～143
W. W. Hansen, Directional charactevistics of any antenna over a plane earch. *J. A. P.*, 1936, **7**(12): 460～465
W. W. Hansen, Transformations useful in certain antenna calculations. *J. A. P.*, 1937, **8**(4): 282～286

[4] 相宝成，庄松林，周学松， 矩形槽光栅的矢量模态理论. 光学学报, 1989, **9**(3): 270～277

[5] 林维德，庄松林，周学松， 对称型闪耀光栅的矢量模态理论. 光学学报, 1991, **11**(7): 624～629

[6] F. Schwering, G. Whitman, A theory of scattering by metal surfaces. *U. S. Army Electronics Command, Fort Monmouth*, NJ. Tech. Rep. ECOM-4496, May 1977

[7] R. Petit, *Electromagnetic Theory of Grating*. Berlin, Hedelberg, New York: (Springer-Verlag, 1980)

[8] P. M. Morse, *H. Feshbach*; *Methods of Theoretical Physics*. McGraw-hill Book Company, Inc, 1953: Part Ⅱ

[9] Zhou Xuesong, *Vector Wave Functions in Electromagnetic Theory*. Berlin, Hedelberg, New York: Springer-Verlag, in printing

A vector model theory for perfectly conducting gratings

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Abstract

In this paper, a vector modal expansion method is used to investigate the diffraction efficiency of optical vector waves for a perfectly conducting reflection grating with grooves of arbitrary cross-section. The results for the special cases of p-and s-polarization are well consistent with that given by ref. [2].

Key words grating, vector modal theory.