OPTIK QALINLIKDAGI MUHITLAR UCHUN KO‘CHIRILISH TENGLAMASINING FAKTORLASHTIRILGAN SHAKLDA IFODALASH USULI VA YECHIMI

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Annotatsiya: Maqolada cheklangan optik qalinlikdagi muhitlar uchun transport tenglamasining faktorlashtirilgan shaklda ifodalash usulidan foydalangan holda masalaning yechimini hisoblash natijalari keltirilgan.

Kalit so’z: Konservativ muhit, ikkilamchi nur, optik qalinlig, **S** va **T-** matritsalar.

Reylning yagona tarqalish matritsasi - $\mathbf{P}\ (\Omega, \Omega_0)$ va aks ettiruvchi matritsasi - $\mathbf{S}\ (\Omega, \Omega_0)$ ning tarqalish yo'nalishiga nisbatan faktorlashtirilgan shakliga asoslangan. Ikkilamchi nurlanishning intensivligi va qutblanishining burchak xarakteristikalari konservativ muhitda, nurlanishning yutilishi bo'lmagan muhitda hisoblanadi. Yarim cheksiz muhit modelidan farqli o'laroq, cheklangan qalinligi bo'lgan muhitda ikkita matritsa kiritiladi $\mathbf{S}(\tau_1, \Omega, \Omega_0)$va $\mathbf{T}(\tau_1, \Omega, \Omega_0)$ular muhitning optik qalinligiga bog'liq. Ushbu matritsalar birlamchi nurlanishning intensivligini orqaga qaytarilgan ikkilamchi nurlanish va muhit qalinligidan o'tgan nurlanishning intensivligi bilan bog'laydi.

Tekis yorug'lik to'lqini cheklangan optik qalinligi bo'lgan muhitga tushsin va $\Omega_0(\theta_0, \varphi_0)$burchaklar $\varphi_0$tomonidan berilgan yo'nalishda tarqalsin θ_0. Tarqalish markazlari tomonidan bir necha marta sochilgandan so'ng, nurlanishning bir qismi $\tau_1 = 0$ diffuz aks ettirilgan orqa nurlanish shaklida qatlam orqali qaytib ketadi va nurlanishning bir qismi $\tau_1$diffuz uzatilgan nurlanish shaklida qatlam orqali chiqib ketadi. Chandrasekhar nazariyasiga ko'ra, aks ettirilgan va uzatilgan nurlanish intensivligi bilan tushayotgan nurlanish o'rtasidagi bog'liqlik

$$I(0, \mu, \varphi) = \frac{F}{4\pi} S(\tau_1; \mu, \varphi; \mu_0, \varphi_0),\ I(0, -\mu, \varphi) = \frac{F}{4\pi} T(\tau_1; \mu, \varphi; \mu_0, \varphi_0) \quad (1)$$

ifodalar bilan belgilanadi, lekin matritsa shaklida.

$$\mathbf{I}_{\text{qaytaril}}\ (\tau = 0, \Omega) = (\widetilde{\omega}_0/4\mu)\mathbf{S}(\tau_1, \Omega, \Omega_{\mathbf{0}})\mathbf{F}(\tau = 0, \overline{\Omega}_{\mathbf{0}}), \quad (2)$$

$$\mathbf{I}_{\text{o‘tkazil}}\ (\tau = \tau_1, \overline{\Omega}) = (\widetilde{\omega}_0/4\mu)\mathbf{T}(\tau_1, \Omega, \Omega_{\mathbf{0}})\mathbf{F}(\tau = 0, \overline{\Omega}_{\mathbf{0}}). \quad (3)$$

Ambartsum invariantlik printsipi yordamida, chegara shartlari bajarilganda, ko‘chirilish tenglamasi uchun umumiy integral tenglamani chiqarish mumkin **S** va **T-** matritsalar almashtirishni hisobga olgan holda, aniqlovchi aks ettiruvchi matritsalar **S** faktorlangan shaklda bo'ladi, matritsani faktorlashtirilgan shaklda **T** ham ko'rsatish mumkin .

$$(1/\mu + 1/\mu_0)\mathbf{S}(\tau_1, \mu, \varphi, \mu_0, \varphi_0) = 3/2\mathbf{U}\Theta(\Omega)((\mathbf{X}(\mu)\mathbf{X}^{+}(\mu_0) - \\ - \mathbf{Y}(\mu)\mathbf{Y}^{+}(\mu_0))\Theta^{+}(\Omega_{\mathbf{0}})\mathbf{U}^{-\mathbf{1}}, \quad (4)$$

$$\left(\frac{1}{\mu} - \frac{1}{\mu_0}\right)\mathbf{T}(\tau_1, \mu, \varphi, \mu_0, \varphi_0) = \frac{3}{2\mathbf{U}\Theta(\Omega)(\mathbf{Y}(\mu)\mathbf{X}^{+}\mu_0)} - \\ - \mathbf{X}(\mu)\mathbf{Y}^{+}(\mu_0))\Theta^{+}(\Omega_{\mathbf{0}})\mathbf{U}^{-\mathbf{1}}\ . \quad (5)$$

$\mathbf{X}(\mu)$ va $\mathbf{Y}(\mu)$ matritsalar uchun τ_1 chiziqli bo'lmagan integral tenglamalar tizimini olamiz,

$$\mathbf{X}(\mu) = \mathbf{1} + \mu\widetilde{\omega}_0 \int_0^1 d\mu' \frac{\Psi(\mu')}{\mu+\mu'} [\mathbf{X}(\mu)\mathbf{X}^{+}(\mu') - \mathbf{Y}(\mu)\mathbf{Y}^{+}(\mu')], \quad (6)$$

$$\mathbf{X}^{+}(\mu) = \mathbf{1} + \mu\widetilde{\omega}_0 \int_0^1 d\mu' \frac{1}{\mu+\mu'} [\mathbf{X}(\mu)\mathbf{X}^{+}(\mu') - \mathbf{Y}(\mu)\mathbf{Y}^{+}(\mu')]\Psi(\mu'), \quad (7)$$

$$\mathbf{Y}(\mu) = \mathbf{1}\exp(-\tau_1/\mu) + \mu\widetilde{\omega}_0 \int_0^1 d\mu' \frac{\Psi(\mu')}{(\mu-\mu')} [\mathbf{Y}(\mu)\mathbf{X}^{+}(\mu') - \mathbf{X}(\mu)\mathbf{Y}^{+}(\mu')], \quad (8)$$

$$\mathbf{Y}^{+}(\mu) = \mathbf{1}\exp(-\tau_1/\mu) + \mu\tilde{\omega}_0 \int_0^1 d\mu' \frac{1}{(\mu-\mu')}[\mathbf{Y}(\mu)\mathbf{X}^{+}(\mu') - \mathbf{X}(\mu)\mathbf{Y}^{+}(\mu')]\Psi(\mu'), \quad (9)$$

identifikatsiya matritsasi qayerda (9x9). $\mathbf{1}$ Olingan tenglamalarda , $\mathbf{X}(\mu)$- $\mathbf{Y}(\mu)$matritsalarning o'lchamlari matritsaning o'lchamlariga mos keladi $\Psi(\mu)$va (9 x 9), ga teng.

Bu yerda shuni ta'kidlash kerakki, qiymatni aniqlash uchun $\mathbf{S}^{(0)}, \mathbf{T}^{(0)}$ Chandrasekhar usuliga ko'ra, to'rtta $X_l(\mu), X_r(\mu), Y_l(\mu), Y_r(\mu)$ skalyar funktsiyalar etarli. Biroq, qo'shimcha hisob-kitoblar amalga oshiriladi. Buning sababi shundaki, konservativ muhitda $X_l(\mu), X_r(\mu), Y_l(\mu), Y_r(\mu)$- funktsiyalar bilan aniqlangan muammoning yechimi noaniq deb hisoblanadi. Noaniqlikni bartaraf etish uchun muammoning aniq yechimlarini ta'minlaydigan qo'shimcha shartlar kiritildi, bu esa analitik va sonli hisob-kitoblarda muammoning yechimini aniqlashning sezilarli murakkablashishiga olib keladi.

Foydalanilgan adabiyotlar

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