IKKI O'LCHAMLI OLMOS PANJARADAGI DISKRET SHREDINGER OPERATORINING SPEKTRI HAQIDA.

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Annotatsiya: *Ikki o'lchamli olmos panjarasidagi diskret Shredinger operatorining muhim spektri o'rganilgan va xos qiymati uchun tenglama olingan.*

Abstract: *The essential spectrum of the discrete Schrödinger operator in a two-dimensional diamond lattice is investigated and an equation for its eigenvalue is obtained.*

Аннотация: *Исследован существенный спектр дискретного оператора Шредингера в двумерной алмазной решетке и получено уравнение для его собственного значения.*

Kalit so'zlar: *Ikki o'lchamli olmos panjaradagi diskret shredenger operatorining muhim spectri, qo'shma operator, kompakt operator, xos qiymat.*

$\mathbb{T}=(-\pi\,;\pi]$, $L_2^{(2)}(\mathbb{T}^2)-\mathbb{T}^2$ da aniqlangan kvadrati bilan integrallanuvchi $\varphi(x)=(\varphi_1(x),\varphi_2(x))$ funksiyalar juftligining Hilbert fazosi bo`lsin. Bu fazoda skalyar ko'paytma quydagicha aniqlangan

$$(\varphi,\psi)=(\varphi_1,\psi_1)+(\varphi_2,\psi_2)$$

Bunda $(\varphi_i,\psi_i)=\int_{\mathbb{T}^2}\varphi_i(x)\overline{\psi_i(x)}\,dx,\quad i=1,2.$

$$H=H_0+Q\,,\qquad (1)$$

bu yerda : H_0 va Q 2×2 o'lchamli matritsa operatorlar bo'lib, $L_2^{(2)}(\mathbb{T}^2)$ da quyidagicha aniqlanadi

$$(H_0\varphi)(x)=\begin{pmatrix}0 & E(x)\\ \overline{E(x)} & 0\end{pmatrix}\begin{pmatrix}\varphi_1(x)\\ \varphi_2(x)\end{pmatrix}=\begin{pmatrix}E(x)\varphi_2(x)\\ \overline{E(x)}\varphi_1(x)\end{pmatrix},$$

$$(Q\varphi)(x)=\begin{pmatrix}Q_1 & 0\\ 0 & Q_2\end{pmatrix}\begin{pmatrix}\varphi_1(x)\\ \varphi_2(x)\end{pmatrix}=\begin{pmatrix}(Q_1\varphi_1)(x)\\ (Q_2\varphi_2)(x)\end{pmatrix},$$

Bunda, $E(x)-$ ikki o`zgaruvchili kompleks qiymatli funksiya

$$E(x)=\tfrac{1}{3}\left(1+e^{ix_1}+e^{ix_2}\right),\quad Q_i-L_2(\mathbb{T}^2)$$

da aniqlangan integral operator

$$(Q_i f_i)(x) = \mu_i \int_{\mathbb{T}^2} \varphi_i(t)dt, \;\; \mu_i > 0, \quad i = 1, 2.$$

1-Lemma : *(1) formula orqali aniqlangan*

$$H =: L_2^{(2)}(\mathbb{T}^2) \to L_2^{(2)}(\mathbb{T}^2)$$

operator chiziqli, chegaralangan va o'z-o'ziga qo'shma operator bo'ladi.

1-Teorema: H_0 *operatorning spektri*

$$\sigma(H_0) = [-1\,;1]$$

to'plamdan iborat bo'ladi.

2-Lemma: $Q \;:\; L_2^{(2)}(\mathbb{T}^2) \to L_2^{(2)}(\mathbb{T}^2)$ *operator kompakt operator bo'ladi.*

2-Teorema: *(1) formula orqali aniqlangan* H *operatorning muhim spektori* H_0 *opretorning spektridan iborat, ya'ni*

$$\sigma_{ess}(H) = \sigma(H_0) = [-1\,;1]$$

bo'ladi.

3-Teorema: $\lambda \notin \sigma_{ess}(H)$ *soni* H *operatorning xos qiymati bo'lishi uchun*

$$\Delta(\lambda) = 0$$

bo'lishi zaruz va yetrli, bu yerda

$$\Delta(\lambda) = \begin{vmatrix} 1 - 4\lambda\mu_1\pi^2 & \mu_2 a(\lambda) \\ \mu_1 \overline{a(\lambda)} & 1 - 4\lambda\mu_2\pi^2 \end{vmatrix},$$

$$a(\lambda) = -\int_{T^2} \frac{E(s)ds}{\lambda^2 - |E(s)|^2}, \quad \overline{a(\lambda)} = -\int_{T^2} \frac{\overline{E(s)}ds}{\lambda^2 - |E(s)|^2}$$

Adabiyotlar

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