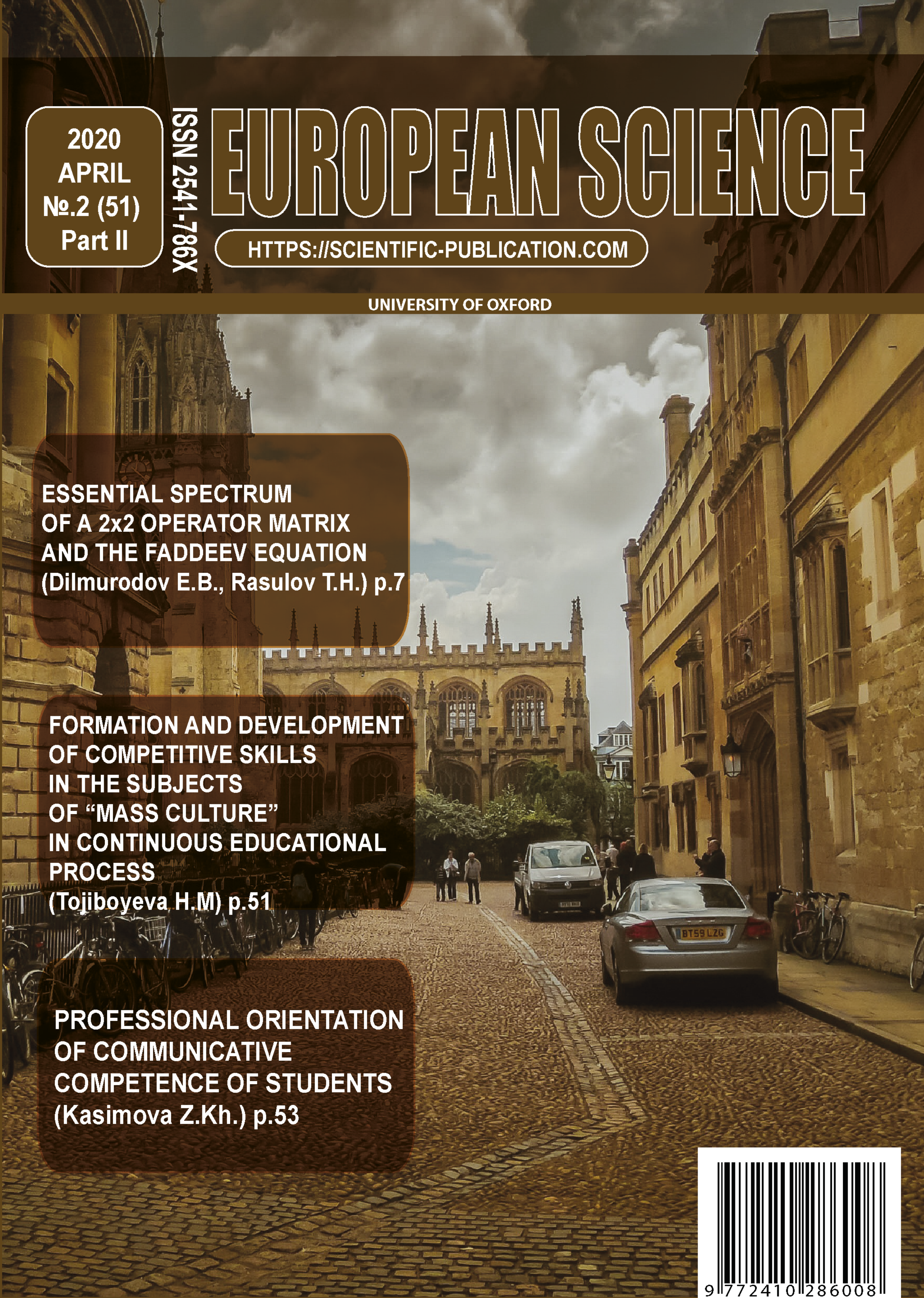

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ESSENTIAL SPECTRUM OF A 2x2 OPERATOR MATRIX AND THE FADDEEV EQUATION

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Abstract: *we consider a* 2×2 *operator matrix* $\mathcal{A}_\mu$, $\mu>0$ *acting in the direct sum of one- and two-particle subspaces of a bosonic Fock space. It is related with the system of non conserved number of quasi-particles. We obtain an analogue of the Faddeev equation for the eigenfunctions of* $\mathcal{A}_\mu$. *We describe the location of the essential spectrum of* $\mathcal{A}_\mu$ *via the spectrum of a family of generalized Friedrichs models. It is shown that the essential spectrum of* $\mathcal{A}_\mu$ *consists the union of at most 3 bounded closed intervals. We introduce new branches of the essential spectrum of* $\mathcal{A}_\mu$.

Keywords: *operator matrix, bosonic Fock space, generalized Friedrichs model, essential spectrum, the Faddeev equation.*

СУЩЕСТВЕННЫЙ СПЕКТР ОДНОЙ 2X2 ОПЕРАТОРНОЙ МАТРИЦЫ И УРАВНЕНИЕ ФАДДЕЕВА

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Аннотация: *рассматривается* 2×2 *операторная матрица* $\mathcal{A}_\mu$, $\mu>0$, *действующая в прямой сумме одно- и двухчастичного подпространства бозонного пространства Фока. Оно связано с системой несохраняющихся чисел квазичастиц. Получен аналог уравнения Фаддеева для собственных функций оператора* $\mathcal{A}_\mu$. *Местоположение существенного спектра оператора* $\mathcal{A}_\mu$ *описано с помощью спектра семейства обобщенных моделей Фридрихса. Показано, что существенный спектр оператора* $\mathcal{A}_\mu$ *состоит из объединения не более трех отрезков. Вводим новые ветви существенного спектра оператора* $\mathcal{A}_\mu$.

Ключевые слова: *операторная матрица, бозонное пространство Фока, обобщенная модель Фридрихса, существенный спектр, уравнение Фаддеева.*

It is well-known that every bounded linear operator acting in the direct sum of two Hilbert spaces always admits 2×2 block operator matrix representation [1]. The problems related with such matrices arise in statistical physics [2], solid-state physics [3] and the theory of quantum fields [4].

In the present paper we consider the family of 2×2 operator matrices $\mathcal{A}_\mu$ ($\mu>0$ is a coupling constant) associated with the lattice systems describing two identical bosons and one particle, another nature in interactions, without conservation of the number of particles. This operator acts in the direct sum of zero-, one- and two-particle subspaces of the bosonic Fock space and it is a lattice analogue of the spin-boson Hamiltonian. We derive an analogue of the Faddeev type system of integral equations for eigenvectors of $\mathcal{A}_\mu$. We describe the location of the essential spectrum $\sigma_{ess}(\mathcal{A}_\mu)$ of $\mathcal{A}_\mu$, via the spectrum of a family of generalized Friedrichs models $\mathcal{A}_\mu(k)$, $k \in T^d$. We introduce a new branches of $\sigma_{ess}(\mathcal{A}_\mu)$ and show that it consists the union of at most 3 bounded closed intervals. We find the discrete spectrum of $\mathcal{A}_\mu$.

Let T^d be the d-dimensional torus, the cube $(-\pi,\pi]^d$ with appropriately identified sides equipped with its Haar measure. Let $L_2(T^d)$ be the Hilbert space of square integrable (complex) functions defined on T^d and $L_2^s((T^d)^2)$ be the Hilbert space of square integrable (complex) symmetric functions defined on $(T^d)^2$. Denote by H the direct sum of spaces $H_1 := L_2(T^d)$ and $H_2 := L_2^s((T^d)^2)$, that is, $H := H_1 \oplus H_2$. The spaces H_1 and H_2 are called one- and two-particle subspaces of a bosonic Fock space $F_s(L_2(T^d))$ over $L_2(T^d)$, respectively.

Let us consider a 2×2 operator matrices $\mathcal{A}_\mu$ acting in the Hilbert space H as

$$\mathcal{A}_\mu := \begin{pmatrix} A_{00} & \mu A_{01} \\ \mu A_{01}^* & A_{11} \end{pmatrix}$$

with the entries

$$(A_{11}f_1)(p) = w_1(k) f_1(p), \quad (A_{12}f_2)(p) = \int_{T^d} v(s) f_2(p,s)\,ds,$$

$$(A_{22}f_2)(p,q) = w_2(p,q) f_2(p,q), \qquad f_i \in H_i, \ i = 1,2,$$

where $\mu > 0$ is a coupling constant, the functions $w_1(\cdot)$ and $w_2(\cdot;\cdot)$ are real-valued continuous functions on T^d and $(T^d)^2$ respectively. In addition the function $w_2(\cdot;\cdot)$ is a symmetric, that is, $w_2(p;q) = w_2(q;p)$ for any $p, q \in T^d$.

Under these assumptions the operator $\mathcal{A}_\mu$ is bounded and self-adjoint.

Let $H_0 := C$. To study the spectrum of the operator $\mathcal{A}_\mu$ we introduce a family of bounded self-adjoint operators (generalized Friedrichs models) $\mathcal{A}_\mu(k), k \in T^d$ which acts in $H_0 \oplus H_1$ operator matrices

$$\mathcal{A}_\mu(k) := \begin{pmatrix} A_{00}(k) & \mu A_{01} \\ \mu A_{01}^* & A_{11}(k) \end{pmatrix}$$

with matrix elements

$$A_{00}(k) f_0 = w_1(k) f_0, \quad (A_{01}f_1) = \int_{T^d} v(t) f_1(t)\,dt, \quad (A_{11}f_2)(p) = w_2(k,p) f_1(p).$$

According to the Weyl theorem, for the essential spectrum of the operator $\mathcal{A}_\mu(k)$, we have $\sigma_{ess}(\mathcal{A}_\mu(k)) = [m(k); M(k)]$, where the numbers $m(k)$ and $M(k)$ are defined by $m(k) := \min\limits_{p\in T^d} w_2(k,p)$ and $M(k) := \max\limits_{p\in T^d} w_2(k,p)$.

For any fixed $k \in T^d$ we define an analytic function $\Delta_\mu(k;\cdot)$ (the Fredholm determinant associated with the operator $\mathcal{A}_\mu(k)$) in $C \setminus [m(k); M(k)]$

$$\Delta_\mu(k;z) := w_1(k) - z - \frac{\mu^2}{2}\int_{T^d} \frac{v^2(t)dt}{w_2(k,t)-z}.$$

Set $m := \min\limits_{p,q\in T^d} w_2(p,q)$, $M := \max\limits_{p,q\in T^d} w_2(p,q)$ and $\Lambda_\mu := \bigcup\limits_{k\in T^d} \sigma_{disc}(\mathcal{A}_\mu(k))$.

We introduce a operator $T_\mu(z)$ acting in H_1 as

$$(T_\mu(z)g)(p) = \frac{\mu^2 v(p)}{2\Delta_\mu(p,z)}\int_{T^d} \frac{v(t)g(t)dt}{w_2(p,t)-z}, \; z \notin \Sigma_\mu := [m; M] \cup \Lambda_\mu.$$

The following theorem [5-15] is an analog of the well-known Faddeev's result for the operator $\mathcal{A}_\mu$.

Theorem 1. The number $z \in C \setminus \Sigma_\mu$ is an eigenvalue of the operator $\mathcal{A}_\mu$ if and only if the number $\lambda = 1$ is an eigenvalue of the operator $T_\mu(z)$. Moreover the eigenvalues z and 1 have the same multiplicities.

We point out that the equation $T_\mu(z)\varphi = \varphi$ is an analogue of the Faddeev type integral equation for eigenfunctions of the operator $\mathcal{A}_\mu$.

Now we describe [11, 12, 16, 17] the location of the essential spectrum of the operator $\mathcal{A}_\mu$ by the spectrum of the family $\mathcal{A}_\mu(k)$ of generalized Friedrichs models.

Theorem 2. For the essential spectrum of $\mathcal{A}_\mu$ the equality $\sigma_{ess}(\mathcal{A}_\mu) = \Sigma_\mu$ holds. Moreover the set Λ_μ consists no more than three bounded closed intervals.

Following we introduce the new subsets of the essential spectrum of $\mathcal{A}_\mu$.

Definition 1. The sets Λ_μ and $[m; M]$ are called two- and three-particle branches of the essential spectrum of $\mathcal{A}_\mu$, respectively.

The definition of the set Λ_μ and the equality $\bigcup\limits_{k\in T^d}[m(k); M(k)] = [m; M]$ together with Theorem 1 give the equality

$$\sigma_{ess}(\mathcal{A}_\mu) = \bigcup_{k\in T^d} \sigma(\mathcal{A}_\mu(k)). \qquad (1)$$

Here the family of operators $\mathcal{A}_\mu(k)$ have a simpler structure than the operator $\mathcal{A}_\mu$. Hence, in many instance, (1) provides an effective tool for the description of the essential spectrum. The spectral properties related with the threshold analysis of a family of 2×2 operator matrices were studied in [18-23]. In the paper [24] spectral inclusion property for diagonally dominant nxn unbounded operator matrices was studied.

References / Список литературы

1. *Tretter C.* Spectral Theory of Block Operator Matrices and Applications, 2008. Imperial College Press.
2. *Minlos R.A., Spohn H.* The three-body problem in radioactive decay: the case of one atom and at most two photons // American Mathematical Society Translations-Series 2, 177, 1996. P. 159-193.
3. *Mogilner A.I.* Hamiltonians in solid state physics as multiparticle discrete Schrodinger operators: problems and results // Advances in Sov. Math. 5, 1991. Pp. 139-194.
4. *Friedrichs K.O.* Perturbation of spectra in Hilbert space // AMS, Providence, Rhode Island, 1965.
5. *Rasulov T.H.* On the finiteness of the discrete spectrum of a 3x3 operator matrix // Methods of Functional Analysis and Topology, 22:1, 2016. Pp. 48-61.
6. *Muminov M.I., Rasulov T.H.* On the eigenvalues of a 2x2 block operator matrix // Opuscula Mathematica. 35:3, 2015. Pp. 369-393.
7. *Rasulov T.Kh.* Discrete spectrum of a model operator in Fock space // Theor. Math. Phys. 153:2, 2007. Pp. 1313-1321.
8. *Rasulov T.Kh.* On the number of eigenvalues of a matrix operator // Siberian Math. J. 52:2, 2011. Pp. 316-328.
9. *Muminov M.I., Rasulov T.Kh.* An eigenvalue multiplicity formula for the Schur complement of a 3x3 block operator matrix // Siberian Math. J. 56:4, 2015. Pp. 878–895.
10. *Muminov M., Neidhardt H., Rasulov T.* On the spectrum of the lattice spin-boson Hamiltonian for any coupling: 1D case // Journal of Mathematical Physics. 56, 2015. 053507.
11. *Rasulov T.Kh.* Branches of the essential spectrum of the lattice spin-boson model with at most two photons // Theoretical and Mathematical Physics. 186:2, 2016. 251-267.
12. *Rasulov T., Tosheva N.* New branches of the essential spectrum of a family of 3x3 operator matrices // Journal of Global Research in Math. Archive. 6:9, 2019. Pp. 18-21.
13. *Muminov M.I., Rasulov T.H.* Embedded eigenvalues of an Hamiltonian in bosonic Fock space // Comm. in Mathematical Analysis. 17:1, 2014. Pp. 1-22.
14. *Rasulov T.H.* The finiteness of the number of eigenvalues of an Hamiltonian in Fock space // Proceedings of IAM, 5:2, 2016. Pp. 156-174.
15. *Muminov M.I., Rasulov T.H.* Infiniteness of the number of eigenvalues embedded in the essential spectrum of a 2x2 operator matrix // Eurasian Mathematical Journal. 5:2, 2014. Pp. 60-77.
16. *Rasulov T.Kh.* Study of the essential spectrum of a matrix operator // Theoret. and Math. Phys. 164:1, (2010. Pp. 883-895.
17. *Rasulov T.H.* Investigations of the essential spectrum of a Hamiltonian in Fock space // Appl. Math. Inf. Sci. 4:3, 2010. Pp. 395-412.
18. *Rasulov T.H., Dilmurodov E.B.* Eigenvalues and virtual levels of a family of 2x2 operator matrices // Methods of Functional Analysis and Topology. 25:1, 2019. Pp. 273-281.
19. *Rasulov T.H., Dilmurodov E.B.* Investigations of the numerical range of a operator matrix. J. Samara State Tech. Univ., Ser. Phys. and Math. Sci. 35:2, 2014. Pp. 50-63.
20. *Rasulov T.H., Dilmurodov E.B.* Threshold analysis for a family of 2x2 operator matrices // Nanosystems: Physics, Chemestry, Mathematics. 10, 2019. № 6. Pp. 616-622.
21. *Rasulov T.H., Dilmurodov E.B.* Threshold effects for a family of 2x2 operator matrices // Journal of Global Research in Mathematical Archives. 6, 2019. № 10. Pp. 4-8.
22. *Dilmurodov E.B.* On the virtual levels of a family matrix operators of order 2 // Scientific reports of Bukhara State University. 2019. № 1. Pp. 42-46.
23. *Rasulov T.Kh., Dilmurodov E.B.* Estimates for quadratic numerical range of a operator matrix // Uzbek Math. Zh., 2015. № 1. Pp. 64-74.
24. Rasulov T., Tretter C. Spectral inclusion for diagonally dominant unbounded operator matrices // Rocky Mountain J. Math., 2018. № 1. 279-324.

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