O'ZBEKISTON RESPUBLIKASI OLIY TA'LIM, FAN VA INNOVATSIYALAR VAZIRLIGI

BUXORO DAVLAT UNIVERSITETI 1930

FIZIKA, MATEMATIKA VA MEXANIKANING DOLZARB MUAMMOLARI XALQARO ILMIY-AMALIY ANJUMANI

MATERIALLARI

Buxoro - 2023

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(I qism)

Buxoro, O‘zbekiston, 24-25-may, 2023-yil

МИНИСТЕРСТВО ВЫСШЕГО ОБРАЗОВАНИЯ, НАУКИ И ИННОВАЦИЙ РЕСПУБЛИКИ УЗБЕКИСТАН
БУХАРСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ

ТЕЗИСЫ ДОКЛАДОВ

(Часть I)

международной научно-практической конференции

АКТУАЛЬНЫЕ ПРОБЛЕМЫ ФИЗИКИ, МАТЕМАТИКИ И МЕХАНИКИ

Бухара, Узбекистан, 24-25 мая, 2023 год

MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATIONS OF THE REPUBLIC OF UZBEKISTAN
BUKHARA STATE UNIVERSITY

ABSTRACTS

(Part I)

of the international scientific and practical conference

ACTUAL PROBLEMS OF PHYSICS, MATHEMATICS AND MECHANICS

Bukhara, Uzbekistan, May 24-25, 2023

$$(K_{11}(\mu,\lambda,\gamma;z)\varphi_1)(x) = \frac{\lambda^2 v(x)}{2}\int_{\mathbb{T}^3}\frac{v(t)\varphi_1(t)dt}{\omega_\gamma(x;\ t)-z},$$

$$(K_{12}(\mu,\lambda,\gamma;z)\varphi_2)(x) = \lambda\mu\int_{\mathbb{T}^3}\frac{v(t)\varphi_2(t)dt}{\omega_\gamma(x;\ t)-z},$$

$$(K_{21}(\mu,\lambda,\gamma;z)\varphi_1)(x) = -\frac{\lambda v(x)}{2}\int_{\mathbb{T}^3}\frac{\varphi_1(t)dt}{\omega_\gamma(x;\ t)-z},$$

$$(K_{22}(\mu,\lambda,\gamma;z)\varphi_2)(x) = -\mu\int_{\mathbb{T}^3}\frac{\varphi_2(t)dt}{\omega_\gamma(x;\ t)-z}.$$

Bunda $\varphi = (\varphi_1,\varphi_2) \in L_2^{(2)}(\mathbb{T}^3)$. Ta'kidlash joizki, har bir $z \in \mathbb{C}\setminus \Sigma_{\mu,\lambda}(\gamma)$ soni uchun $T_{\mu,\lambda}(\gamma;z)$ kompakt operator bo'ladi.

Quyidagi lemma $H_{\mu,\lambda}(\gamma)$ operatorli matritsa uchun mashhur Faddeyev natijasining analogi bo'lib, $H_{\mu,\lambda}(\gamma)$ va $T_{\mu,\lambda}(\gamma;z)$ operatorli matritsalarning xos qiymatlari orasidagi bog'lanishni ifodalaydi.

Teorema. *Har bir tayinlangan* μ,λ,γ *sonlari uchun* $z \in \mathbb{C}\setminus \Sigma_{\mu,\lambda}(\gamma)$ *soni* $H_{\mu,\lambda}(\gamma)$ *operatorli matritsaning xos qiymati bo'lishi uchun* 1 *soni* $T_{\mu,\lambda}(\gamma;z)$ *operatorli matritsaning xos qiymati bo'lishi zarur va yetarlidir. Bundan tashqari, z va* 1 *xos qiymatlar bir xil karralikga egadir.*

FOYDALANILGAN ADABIYOTLAR RO'YXATI

1. Rasulov T.H., Dilmurodov E.B. Estimates for the bounds of the essential spectrum of a 2×2 operator matrix. Contemporary Mathematics. 1:4 (2020), P. 170–182.

EXAMPLE OF TWO-DIMENSIONAL QnSO

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Let $I = \{1,2,\ldots,m\}$. A distribution (or state) of the set I is a probability measure $x = (x_1,\ldots,x_m)$, i.e. an element of the simplex:

$$S^{m-1}=\left\{x\in\mathbb{R}^m : x_i\geq 0, \sum_{i=1}^{m} x_i=1\right\}. \tag{1}$$

The quadratic stochastic operator (QSO) is a mapping of the simplex S^{m-1} into itself, of the form

$$V: x_k'=\sum_{i,j=1}^{m} P_{ij,k}x_i x_j,\ k=1,\dots,m \tag{2}$$

where $P_{ij,k}$ are coefficients of heredity and

$$P_{ij,k}\geq 0,\ P_{ij,k}=P_{ji,k},\ \sum_{k=1}^{m} P_{ij,k}=1,\ i,j,k=1,\dots,m, \tag{3}$$

Thus, each quadratic stochastic operator V can be uniquely defined by a cubic matrix $\mathbf{P}=\left(P_{ij,k}\right)_{i,j,k=1}^{n}$ with conditions (3).

For a given $x^{(0)}\in S^{m-1}$ the trajectory (orbit) $\{x^{(n)}\}$of $x^{(0)}$ under the faction of QSO (2) is defined by

$$x^{(n+1)}=V(x^{(n)}), \text{where } n=0,1,2,\dots.$$

In general, a quadratic operator V, $V: x\in\mathbb{R}^m\to x'=V(x)\in\mathbb{R}^m$ corresponding to a cubic matrix $\mathbf{P}$ is defined by (2). Without loss of generality we assume $P_{ij,k}=P_{ji,k}$. Indeed, if this equality is not satisfied then we can introduce $\overline{P}_{ij,k}=\frac{1}{2}(P_{ij,k}+P_{ji,k})$.

Definition. *A quadratic operator* (2)*, preserving a simplex, is called non-stochastic (QnSO) if at least one of its coefficients* $P_{ij,k}, i\neq j$ *is negative.*

Now we study the following example of QnSO on the 2D-simplex S^2:

$$\begin{aligned} x' &= x^2+y^2+z^2-axy-axz+2yz \\ y' &= (2+a)xy \\ z' &= (2+a)xz, \end{aligned} \tag{4}$$

where $a\in[0,2]$. Note that $P_{12,1}=P_{13,1}=-a/2$.

The following points are fixed points of the operator *(4):*

$$p_y=\left(\frac{1}{2+a}, y, 1-\frac{1}{2+a}-y\right), \text{ where } \quad y\in\left[0, 1-\frac{1}{2+a}\right].$$

On invariant sets. Recall that a set M is called invariant with respect to an operator V if $V(M) \subset M$.

It is easy to see that the following sets are invariant with respect to (4):

$$M_0 = \{(x, y, z) \in S^2 : y = 0\}, \ M_1 = \{(x, y, z) \in S^2 : z = 0\},$$

$$M_\omega = \{(x, y, z) \in S^2 : y = \omega z\}, \ \omega \in [0, +\infty).$$

Remark. *As we have seen, the operator* (4) *is chaotic for* $1.56995 < a \leq 2$, *but it is not chaos on the simplex in the sense of Devaney. Because, it is not topologically transitive. It is splitted chaos meaning that the simplex is partitioned into uncountably many invariant subsets and the restriction of the operator* (4) *on each invariant set is chaos in the sense of Devaney.*

References

1. Devaney R.L. // An introduction to chaotic dynamical systems. Boulder, Stud. Nonlinearity, Westview Press, 2003.
2. Rozikov U.A, Xudayarov S.S. Quadratic non-stochastic operators: examples of splitted chaos // Annals of Functional Analysis. 13:17, (2022). P. 1-17

О ЧИСЛЕ СОБСТВЕННЫХ ЗНАЧЕНИЙ МОДЕЛЬНОГО ОПЕРАТОРА ТИПА ШРЕДИНГЕРА НА РЕШЕТКЕ

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В работе [1] рассматривается система трех частиц (две из них - бозоны, а третья -произвольная), взаимодействующих с помощью парных контактных потенциалов притяжения. Описан существенный спектр ассоциированного этой системе трехчастичного оператора $H_{\mu_1\mu_3}(\boldsymbol{K})$. Доказано существование эффекта Ефимова для $H_{\mu_1\mu_3}(\boldsymbol{0})$ в случаях, когда либо две, либо три двухчастичные