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mavzusidagi Respublika ilmiy-texnik anjuman materiallari to‘plami

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Respublika miqyosidagi ilmiy-texnik anjuman materiallarida zamonaviy kompyuter ilmlari va muhandislik texnologiyalari sohasidagi innovatsion tadqiqotlar aks etgan.

Globallashuv sharoitida davlatimizni yanada barqaror va jadal sur’atlar bilan rivojlantirish bo‘yicha amalga oshirilayotgan islohotlar samarasini yaxshilash sohasidagi ilmiy-tadqiqot ishlariga alohida e’tibor qaratilgan. Zero iqtisodiyotning, ijtimoiy sohalarni qamrab olgan modernizatsiya jarayonlari, hayotning barcha sohalarini liberallashtirishni talab qilmoqda.

Ushbu ilmiy ma’ruza tezislari to‘plamida mamlakatimiz va xorijlik turli yo‘nalishlarda faoliyat olib borayotgan mutaxassislar, olimlar, professor-o‘qituvchilar, ilmiy tadqiqot institutlari va markazlarining ilmiy xodimlari, tadqiqotchilari, magistr va talabalarning ilmiy-tadqiqot ishlari natijalari mujassamlashgan.

Mazkur to‘plamga kiritilgan ma’ruza tezislarining mazmuni, undagi statistik ma’lumotlar va me’yoriy hujjatlarning to‘g‘riligi hamda tanqidiy fikr-mulohazalar, keltirilgan takliflarga mualliflarning o‘zlari mas’uldirlar.

10. Джалилов А.А., Абдухакимов С.Х., Случайные возмущения для семейства унимодальных отображений // Доклады Академии наук Республики Узбекистан, Ташкент, 2021, №2, с. 9-14.

THE ROTATIONAL FLOW OF TWO-DIMENSIONAL ALGEBRAS AND ITS APPLICATIONS

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Abstract: In this thesis, we examine a time-dependent family of two-dimensional algebras, referred to as the circular flow of algebras, and provide information regarding some of its applications. We investigate the cases of two algebras belonging to this family formed at different points in time. Our findings reveal that this flow consists of uncountably many pairwise non-isomorphic algebras, including one commutative algebra.

Keywords: *Finite-dimensional algebra, matrix, time-dependent function, cubic matrix, isomorphism of algebras, flow of algebras.*

A cubic matrix $Q = \left(q_{ijk}\right)_{i,j,k=1}^{m}$ is an m^3-dimensional vector which can be uniquely written as

$$Q = \sum_{i,j,k=1}^{m} q_{ijk}E_{ijk},$$

where E_{ijk} denotes the cubic unit matrix, i.e. E_{ijk} is a m^3-cubic matrix whose *(i, j, k)*th entry is equal to 1 and all other entries are equal to 0. Denote by $\mathcal{C}$ the set of all cubic matrices over a field F. Then $\mathcal{C}$ is an m^3-dimensional vector space over F, i.e. for any matrices $A = \left(a_{ijk}\right)_{i,j,k=1}^{m}, B = \left(b_{ijk}\right)_{i,j,k=1}^{m} \in C, \mu \in F$, we have

$$A + B = \left(a_{ijk} + b_{ijk}\right)_{i,j,k=1}^{m} \in C,\ \mu A = \left(\mu a_{ijk}\right)_{i,j,k=1}^{m} \in C.$$

In [4] (see also [5]), some simple versions of multiplications between cubic matrices are given.

Following [6] we define a notion of flow of algebras (FA). Consider a family

$$\left\{A^{[s,t]} : s, t \in R, 0 \le s \le t\right\}$$

of arbitrary m-dimensional algebras over the field R, with basis $e_1, e_2, \dots, e_m$ and multiplication table

$$e_i e_j = \sum_{k=1}^{m} c_{ijk}^{[s,t]} e_k, \qquad i, j = 1, \dots, m.$$

Here parameters s, t are considered as time. Denote by $M^{[s,t]} = \left(c_{ijk}^{[s,t]}\right)_{i,j,k=1,\dots,m}$ the matrix of structural constants of $A^{[s,t]}$ [2].

Definition: *Fix an arbitrary multiplication of cubic matrices, say* $*_\alpha$. *A family* $\{A^{[s,t]}: s,t \in R, 0 \le s \le t\}$ *of* m*-dimensional algebras over the field* R *is called a flow of algebras (FA) of type* α *if the matrices* $M^{[s,t]}$ *of structural constants satisfy the Kolmogorov–Chapman equation (for cubic matrices):* $M^{[s,t]} = M^{[s,\tau]} *_\alpha M^{[\tau,t]}$, *for all* $0 \le s < \tau < t$.

Consider one of the defined multiplication for cubic matrices. If $C = AB$, then it follows that

$$c_{ijr} = \sum_{k=1}^{m} a_{ijk} b_{kjr}.$$

Write cubic matrix $M^{[s,t]}$ for $m = 2$ in the following convenient form:

$$M^{[s,t]} = \left(\begin{array}{cc|cc} c_{111}^{[s,t]} & c_{112}^{[s,t]} & c_{211}^{[s,t]} & c_{212}^{[s,t]} \\ c_{121}^{[s,t]} & c_{122}^{[s,t]} & c_{221}^{[s,t]} & c_{222}^{[s,t]} \end{array}\right).$$

We consider the following cubic matrix, which generates an FA:

$$M^{[s,t]} = \left(\begin{array}{cc|cc} \cos(t-s) & \sin(t-s) & -\sin(t-s) & \cos(t-s) \\ \cos(t-s) & -\sin(t-s) & \sin(t-s) & \cos(t-s) \end{array}\right).$$

This FA is called rotational flow of two-dimensional algebras [9]. Detailed information regarding the essential properties, applications, and further insights into the flow of these algebras can be found in [7,9].

In today’s information-driven world, data security is not just a technical task but a basic mathematical problem. Creating new cryptosystems that change over time (time-dependent systems) has become a very important area of research [1,3,8]. You can find more about how the flows of two-dimensional algebras we mentioned are used in encryption systems in paper [7].

The model proposed in this research differs from standard matrix multiplication because it is carried out using a family of time-dependent matrices, $M^{[0,t]}$. The encryption process takes the plaintext as a vector $a = (\alpha, \beta)$ in the R^2 space. At any given time t, the encryption follows a two-step “Double Encryption” procedure:

Step one: Multiplication of the vector by the first block of the matrix:

$$\left(u_1^a(t), u_2^a(t)\right) = (\alpha, \beta) \cdot \begin{pmatrix} c_{111}^{[0,t]} & c_{112}^{[0,t]} \\ c_{211}^{[0,t]} & c_{212}^{[0,t]} \end{pmatrix};$$

Step two: Vector multiplication with the second block of the matrix:

$$\left(v_1^a(t), v_2^a(t)\right) = (\alpha, \beta) \cdot \begin{pmatrix} c_{121}^{[0,t]} & c_{122}^{[0,t]} \\ c_{221}^{[0,t]} & c_{222}^{[0,t]} \end{pmatrix}$$

Here, the matrix $M^{[0,t]}$ consists of trigonometric functions, and its elements provide a continuous rotation over time.

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KO‘P QATLAMLI SILINDRIK QOBIQ VA QOVUSHQOQ–ELASTIK YARIM TEKISLIK TIZIMIDA GARMONIK TO‘LQINLAR TARQALISHINING NAZARIY TAHLILI

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Annotatsiya: Mazkur maqolada ko‘p qatlamli silindrik qobiq va qovushqoq–elastik yarim tekislikdan iborat tizimda garmonik to‘lqinlar tarqalishining nazariy tahlili keltirilgan. Tizim uchun matematik model tuzilib, dispersiya tenglamasi chiqarilgan. Qovushqoqlik, elastiklik va qatlamlar sonining to‘lqin tarqalish xususiyatlariga ta’siri o‘rganilgan.

Kalit so‘zlar: ko‘p qatlamli qobiq, qovushqoq-elastik muhit, garmonik to‘lqinlar, dispersiya, tebranish, nazariy tahlil.

Ko‘p qatlamli elastik strukturalarda to‘lqin jarayonlarini o‘rganish zamonaviy mexanika va muhandislikning muhim yo‘nalishlaridan biridir. Ayniqsa, silindrik qobiqlar va ularning deformatsiya xususiyatlari sanoatning turli sohalarida keng qo‘llaniladi.

Qovushqoq–elastik muhit bilan o‘zaro ta’sirda bo‘lgan qobiqlarda to‘lqinlarning tarqalishi murakkab dinamik jarayon bo‘lib, u quyidagi omillarga bog‘liq:

- muhitning qovushqoqligi,