МИНИСТЕРСТВО ВЫСШЕГО И СРЕДНЕГО СПЕЦИАЛЬНОГО ОБРАЗОВАНИЯ РЕСПУБЛИКИ УЗБЕКИСТАН

НАЦИОНАЛЬНЫЙ УНИВЕРСИТЕТ УЗБЕКИСТАНА имени МИРЗО УЛУГБЕКА

ИНСТИТУТ МАТЕМАТИКИ имени В.И. РОМАНОВСКОГО АН РУз

ТЕЗИСЫ ДОКЛАДОВ

Республиканской научной конференции
с участием зарубежных ученых

САРЫМСАКОВСКИЕ ЧТЕНИЯ

16–18 сентября 2021 года Ташкент, Узбекистан

Ташкент–2021

Rakhmonov Z.R., Salimov J.I. *On the asymtotic of the solution of a nonlinear filtration problem with a source and multiple nonlinearities* 262
Rozikov U. A., Narkuziyev B.A. *On classification in some chains of evolution algebras* 263
Rozikov U.A., Xudayarov S.S. *A quadratic non-stochastic operator* 265
Samatov B.T., Akbarov A.Kh., Jurayev B.I. *Differential Game of Pursuit under GrG-constraints on Controls* 267
Sanoqulova S. *Derivation of some nilpotent Leibniz superalgebras* 269
Sattarov A.M. *The algebraic classification of 4-dimensional nilpotent left symmetric algebras* 271
Sattorov E.N., Ermamatova Z. E. *Carleman's formula of a solutions of the Poisson equation in bounded domain* 273
Shopulatov Sh.Sh. *A new integral criterion for m - subharmonic functions* ... 275
Shoyimardonov S. K. *Uniqueness of interior fixed point of the operator related to epidemic SISI model* 277
Sultanov B.M. *The development of surfaces in Galilean space* 278
Takhirov J.O., Asrakulova D.S. *On the mathematical model SARS-COV-2 inside the object* 279
Tashpulatov S.M., Parmanova R.T. *Structure of essential spectra and discrete spectrum of four-electron systems in the impurity Hubbard model. First triplet state* . 280
Tukhtabaev A. M. *Boundedness of p-adic ART quasi Gibbs measures* 282
Tulakova Z.R. *The Neumann problem for a multidimensional elliptic equation with several singular coefficients in an infinite domain* 284
Umirkhonov M.T. *On wave solutions for a class of nonlinear viscoelastic media* .. 286
Usmanov Salim *Maximal operators associated with surfaces* 287
Arabboyev A.B. *Sug'urta kompaniyasining sug'urta mukofot pulini to'lay olmaslik riski va uning erkin zahiralari* 288
Arzikulov F.N., Husanova N. T. *Involyutiv algebra ustida aniqlangan o'z-o'ziga qo'shma matritsalar Yordan algebrasi 2-lokal differensiallashlari tavsifi haqida* 290
Axmedov S.A., Yuldashev X.D., Shukurillayeva K.N. *Pedagogik va psixologik jarayonlarni o'rganishda nazorat kartalardan foydalanish haqida.* 292
Davlatova D.Q., Solijanova G.O. *Ba'zi yechiluvchanga yaqin Li algebrasining differensiallashlar fazosi* 294
Ibragimov J.O. *Elliptik silindr ustida Yakobi vektor maydoni* 296
Jo'raboyev S.S. *Simplektik gruppaning haqiqiy tasvirlari gruppasi ta'siriga nisbatan differensial invariantlari* 297
Karimov N. M. *Ikki armiyaning jangovar harakatlari modeli diskret boshqaruvli sistema sifatida* 299
Kucharov R.R., Xushvaqtov N.X. *Nomanfiy yadroli Fridrixs modeli xos qiymatlari.* 302
Mahmudjonova Z.O. Solijanova G.O. *Ba'zi yechiluvchanga yaqin Li algebrasining quyi tartibli kogomologik gruppalari* 303
Mavlonov I.M., Aminov B.R. *ℓ_p fazosidagi birlik shar ekstremal nuqtalarining bir xossasi* 305
Mo'minov Z.E., Madatova F.A. *Diskret Laplasianning Green funksiyasi uchun asimptotika* 307
Raxmatullayev M.M., Abrayev B.O'. *Raqobatlashuvchi SOS modeli uchun Keli daraxtida sanoqlita davriy bo'lmagan asosiy holatlar* 309
Saitova S.S., Ergashova Sh. R. *Jamiyat diskret qism fazolar yordamida qurilgan fazo* 311
Аблазова К.С. *Заводдаги технологик операцияларда чиқаётган нуқсонлар улушини статистик методлар билан аниқлаш босқичлари ҳақида* 312
Акмалова Р.А., Файзиева Ф.А. *Индексии 3 булган нормал булувчига нисбатан даврий гармоник функциялар* 314

3. A.N. Imomkulov, M.V. Velasco, *Chain of three-dimensional evolution algebras*, *Filomat*, **34**(10) (2020), 3175-3190.

4. A.N. Imomkulov, *Classification of a family of three dimensional real evolution algebras*, *TWMS J. Pure Appl. Math.*, **10**(2) (2019), 225-238.

5. B.A. Narkuziyev, U.A. Rozikov, *Classification in chains of three-dimensional real evolution algebras* *arXiv:2107.02756v1* .

A quadratic non-stochastic operator

Rozikov U. A.[1], Xudayarov S. S.[2]

V.I. Romanovskiy Institute of mathematics, Tashkent, Uzbekistan,
rozikovu@yandex.ru;
Bukhara state university, Bukhara, Uzbekistan,
xsanat83@mail.ru

Non-linear dynamical systems arise in many problems of biology, physics and other sciences. In particular, quadratic dynamical systems describe the behavior of populations of different species with population models ([1],[2],[3]) Let S^{m-1} be the $m-1$ dimensional standard simplex and $V : R^m \to R^m$ be a quadratic operator which is given by the following from:

$$V(x)_k = \sum_{i,j=1}^{m} P_{ij,k} x_i x_j \tag{1}$$

for $k = 1, \ldots, m.$, where $p_{ij,k} = p_{ji,k} \in R$ for $i, j, k \in N_m = \{1, 2, \ldots, m\}$

Definition. *A quadratic operator (1) preserving a simplex is called non-stochastic if at least one of its coefficients $P_{ij,k}$, $i \neq j$ is negative.*

Consider

$$P_{ii,i} = 1, \quad P_{ii,k} = 1, \forall i = 1, 2, 3; \ \forall k = 2, 3;$$

$$P_{ij,1} = -\frac{1}{2}\sqrt{P_{ii,1}P_{jj,1}} = -\frac{1}{2}, \ \ \forall i \neq j;$$

$$P_{ij,k} \in \left[0, \frac{3}{2}\right], \ \forall i \neq j, \ \ k = 2, 3 \quad \text{with} \quad P_{ij,2} + P_{ij,3} = \frac{3}{2}$$

Then taking some parameters equal to zero we get the following quadratic operator V :

$$\begin{aligned} x' &= x^2 + y^2 + z^2 - xy - xz - yz \\ y' &= 3xy + ayz \\ z' &= 3xz + (3-a)yz, \end{aligned} \tag{2}$$

where $a \in (0, 3)$ and $(x, y, z) \in S^2 = \{(x, y, z) \in R^m : x + y + z = 1\}$. It is easy to see that the fixed points of the operator (2) are

$$s_1 = (1,0,0), \quad s_2 = \left(\frac{1}{3}, 0, \frac{2}{3}\right),$$
$$s_3 = \left(\frac{1}{3}, \frac{2}{3}, 0\right), \quad s_4 = \left(\frac{a^2-3a+3}{a^2-3a+9}, \frac{2a}{a^2-3a+9}, \frac{2(3-a)}{a^2-3a+9}\right).$$

Let $a \in (0,3)$. Introduce the following sets:

$$M_1 = \{(y,z) \in [0,1]^2 : y = 0\}, \quad M_2 = \{(y,z) \in [0,1]^2 : z = 0\},$$
$$M_3 = \left\{(y,z) \in [0,1]^2 : y + z \le 1, z = \frac{3-a}{a} \cdot y\right\},$$
$$M_4 = \left\{(y,z) \in [0,1]^2 : y + z \le 1, z < \frac{3-a}{a} \cdot y\right\},$$
$$M_5 = \left\{(y,z) \in [0,1]^2 : y + z \le 1, z > \frac{3-a}{a} \cdot y\right\}.$$

and

$$\widehat{M_i} = \{(x,y,z) \in S^2 : (y,z) \in M_i\}, \quad i = \overline{1,5}.$$

Then

$$S^2 = \bigcup_{i=1}^{5} \widehat{M_i}.$$

Theorem. *If $(x^{(0)}, y^{(0)}, z^{(0)}) \in \widehat{M_i}$ for some $i = 1,2,3,4,5$ then for the operator(2) the following holds*

$$\lim_{n\to\infty} V^n(x^{(0)}, y^{(0)}, z^{(0)}) = \begin{cases} s_1 & \text{if } \ x^{(0)} = 1 \\ s_2 & \text{if } \ i = 1, \quad z^{(0)} > 0 \\ s_3 & \text{if } \ i = 2, \quad y^{(0)} > 0 \\ s_4 & \text{if } \ i = 3, \quad y^{(0)} > 0 \\ \in \widehat{M_3} & \text{if } \ i = 4,5. \end{cases}$$

Conjecture. If $(x^{(0)}, y^{(0)}, z^{(0)}) \in \widehat{M_4} \bigcup \widehat{M_5}$ then for the operator (2) the following holds

$$\lim_{n\to\infty} V^n(x^{(0)}, y^{(0)}, z^{(0)}) = s_4.$$

REFERENCES

1. Kesten H., Quadratic transformations: a model for population growth. I, II, Adv. // Appl.Probab, 2 (1970) 1-82; 179-228.

2. Yu.I. Lyubich, Mathematical structures in population genetics,// Springer-Verlag, 1992.

3. Rozikov U.A., Population dynamics: algebraic and probabilistic approach.World Sci. Publ.// Singapore.2020.