l-VOLTERRA KVADRATIK STOXASTIK OPERATORNING DINAMIKASI

[1] **Hamrayev A.Yu.**
[2] **To`xtayeva D.D.**
[1] **khamrayev_a@yandex.ru**
[2] **durdonamustafo1620@gmail.com**
Qarshi davlat Universiteti, Qarshi, O‘zbekiston
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Annotatsiya. *Ushbu ishda l-Volterra kvadratik stoxastik operatorning qo ‘zg ‘almas nuqtalari topilgan va tiplarga ajratilgan.*

Biror $l \in \{1, 2, \dots, m\}$ sonni fiksirlab olamiz. V kvadratik stoxastik operatoning, ya’ni:

$$V : S^2 \to S^2 = \{(x, y, z) \in R^3 : x \geq 0,\ y \geq 0,\ z \geq 0,\ x + y + z = 1\}$$

$$V_{xk} = x'_k = \sum_{i,j=1}^{n} P_{ij,k} x_i x_j \qquad (1)$$

$$P_{ij,k} = P_{ji,k} \geq 0, \ \sum_{k=1}^{n} P_{ij,k} = 1 \qquad (2)$$

(1) va (2) ga kvadratik stoxastik operator deb ataladi.

Ta’rif [1]. *Agar (1), (2) bilan aniqlangan operatorning koeffitsiyentlar quyidagi*

- $P_{ij,k} = 0$ *agar* $k \notin \{i, j\}, \ \forall k = 1, \dots, l, \ i, j = \{1, \dots, m\}$,
- $P_{ij,k} > 0$, *agar kamida bitta* (i, j) $i \neq k, \ j \neq k$ *juftlik va* $\forall k \in \{l+1, \dots, m\}$

shartlarni qanoatlantirsa $\forall l \in \{1, \dots, m\}$ *uchun. U holda bu operator* l*-kvadratik stoxastik operator deb ataladi.*

Biz $V : S^2 \to S^2$ operatorni qaraymiz:

$$V : \begin{cases} x'_1 = x_1^2 + dx_3^2 + 2x_1x_3 \\ x'_2 = x_2^2 + 2x_1x_2 \\ x'_3 = cx_3^2 + 2x_2x_3 \end{cases} \qquad (3)$$

bu yerda $c, d \geq 0$ va $c + d = 1$.

Teorema. *(3)-*l *-Volterra kvadratik stoxastik operator uchun quyidagilar o`rinli:*

i) $\Gamma_{\{12\}} = \{x \in S^2 : x_3 = 0\}$ *va* $\Gamma_{\{13\}} = \{x \in S^2 : x_2 = 0\}$ *to`plamlar invariantdir.*

ii)
$$Fix(V) = \begin{cases} \{\mathbf{e}_1, \mathbf{e}_2, \mathbf{e}_3, \mathbf{x}^*\}, \ agar\ 0 \leq c < 1, \\ \{\mathbf{e}_1, \mathbf{e}_2, \mathbf{e}_3, \mathbf{c}\}, \ agar\ c = 1. \end{cases}$$

Simpleksning $\mathbf{e}_1, \mathbf{e}_2, \mathbf{e}_3$ *uchlari egar nuqtalar va agar* $c = 0$ *bo`lsa* $\mathbf{x}^*$ *qo`zg`almas nuqta nogiperbolik va agar* $0 < c < 1$ *bo`lsa* $\mathbf{x}^*$ *qo`zg`almas nuqta nogiperbolik itaruvchi nuqta bo`ladi.Simpleks markazi* $\mathbf{c}$ *nuqta itaruvchi qo`zg`almas nuqtadir.*

Adabiyotlar, References, Литературы:

1. Devaney R. L. An introduction to chaotic dynamical system. Westview Press, 2003.