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**O'ZBEKISTON RESPUBLIKASI  
INNOVATSION  
RIVOJLANISH VAZIRLIGI**

# **МАТЕМАТИКА, ФИЗИКА ВА АХБОРОТ ТЕХНОЛОГИЯЛАРИНИНГ ДОЛЗАРБ МУАММОЛАРИ**

**МАВЗУСИДАГИ РЕСПУБЛИКА  
МИҚЁСИДАГИ ОНЛАЙН  
ИЛМИЙ-АМАЛИЙ АНЖУМАНИ**

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**BUXORO DAVLAT UNIVERSITETI**

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the block numerical range of  $A$  with respect to  $H = H_1 \oplus \dots \oplus H_n$ ; for a fixed decomposition of  $H$ , we also write

$$W^n(A) = W_{H_1 \oplus \dots \oplus H_n}(A).$$

For  $n = 1$  the block numerical range is just the usual numerical range, for  $n = 2$  it is the quadratic numerical range. For  $n = 3$ , the block numerical range is also called cubic numerical range and for  $n = 4$  quartic numerical range.

The next result is a straightforward generalization of the fact that the numerical range contains the quadratic numerical range [1].

Theorem 1.  $W^n(A) \subset W(A)$ .

We define the diagonal part  $T$  and the off-diagonal part  $S$  by

$$T := \{A_{11}, \dots, A_{nn}\}, S := A - T,$$

and we call  $A$  diagonally dominant of order  $\delta_S$  if  $S$  is  $T$ -bounded with  $T$ -bound  $\delta_S$ .

The approximate point spectrum of  $A$  is defined as

$$\sigma_{app}(A) := \{\lambda \in \mathbb{C} : \text{there exist } (f^{(\nu)})_1^\infty \subset D(A), \|f^{(\nu)}\| = 1, (A - \lambda)f^{(\nu)} \rightarrow 0, \nu \rightarrow \infty\}.$$

In the following we give analogs of spectral inclusions for the block numerical range of diagonally dominant unbounded  $n \times n$  operator matrices.

Theorem 2.  $\sigma_p(A) \subset W^n(A)$ .

Theorem 3. If  $A$  is a diagonally dominant  $n \times n$  operator matrix of order 0, then

$$\sigma_{app}(A) \subset \overline{W^n(A)}.$$

If  $\Omega$  is a component of  $C \setminus \overline{W^n(A)}$  that contains a point  $\mu \in \rho(A)$ , then  $\Omega \subset \rho(A)$ ; in particular, if every component of  $C \setminus \overline{W^n(A)}$  contains a point  $\mu \in \rho(A)$ , then

$$\sigma(A) \subset \overline{W^n(A)}.$$

Since the numerical range is convex, the complement  $C \setminus \overline{W(A)}$  has at most two components. The number of components of  $C \setminus \overline{W^n(A)}$  for  $n > 1$  is still unknown.

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## IKKI O'LCHAMLI PANJARADA IKKI ZARRACHALI GAMIL'TONIANNING SPEKTRI HAQIDA

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$T = (-\pi, \pi]$ ,  $L_2(T^2) - T^2$  da aniqlangan kvadrati bilan integrallanuvchi funksiyalarning Hilbert fazosi.  $L_2(T)$  fazoda quyidagi formula orqali ta'sir qiluvchi  $h(k)$ ,  $k \in T^2$ , - o'z-o'ziga qo'shma operatorni qaraymiz:

$$h(k) = h_0(k) - V,$$

bu yerda  $h_0(k)$  -operator

$$\tilde{\varepsilon}_k(p) = \sum_{i=1}^2 \left( \frac{1}{m_1} + \frac{1}{m_2} - \sqrt{\frac{1}{m_1^2} + \frac{2}{m_1 m_2} \cos 2nk_i + \frac{1}{m_2^2} \cos 2np_i} \right)$$

funksiyaga ko'paytirish operatori va  $V$  – integral operator bo'lib, uning yadrosi

$$v(p - q) = \sum_{i=0}^N \sum_{j=1}^2 \mu_{ij} \cos l(p_i - q_j)$$

funksiyadan iborat. Bu yerda  $m_1, m_2$  – zarachalarning massalari.

$$n = \begin{cases} 2EKUK\{1, 2, 3, \dots, N-1\} & \text{agar } N > 1, \\ 1, & \text{agar } N = 1. \end{cases}$$

**1-Faraz.** Faraz qilaylik,  $m = m_1 = m_2$  va  $k = (k_1, k_2) \in T^2$  ning hech bo'lmaganda biror koordinatsi  $\pm \frac{\pi}{2n}$  ga teng bo'lsin.

**1-Teorema.** 1-farazimiz bajarilmasin. U holda quyidagi tasdiqlar o'rinli.

1. Agarda  $\frac{n}{2N}$  – natural son bo'lsa, u holda ixtiyoriy  $\mu = (\mu_0, \dots, \mu_N) \in R_+^{N+1}$  uchun  $h(k)$  operatorning muhim spektridan chapda karraliklari bilan qushib hisoblaganda  $4N + 1$  ta xos qiymati mavjud.

2. Agarda  $\frac{n}{2N}$  – kasr son bo'lsa, u holda ixtiyoriy  $\mu = (\mu_0, \dots, \mu_{N-1}) \in R_+^N$  va  $\mu_{Ni} \in M_{\alpha_i}$  uchun  $h(k)$  operatorning muhim spektridan chapda karraliklari bilan qushib hisoblaganda  $4N - 1 + \sum_{i=1}^2 \alpha_i$  ta xos qiymati mavjud, bu yerda

$$M_{0i} = (0; \mu^0(k)], M_{1i} = (\mu^0(k); \infty), \alpha_i \in \{0; 1\}.$$

**2-Teorema.** 1-farazimiz bajarilsin. U holda ixtiyoriy  $\mu = (\mu_0, \dots, \mu_N) \in R_+^{N+1}$  uchun  $h(k)$  operatorning muhim spektridan chapda karraliklari bilan qushib hisoblaganda  $4N + 1$  ta xos qiymati mavjud.

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## SOME CARDINAL PROPERTIES OF SPACE OF THE PERMUTATION DEGREE AND HYPERSPACES

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Let  $X^n$  be the  $n$ th power of a compact  $X$ . The permutation group  $S_n$  of all permutations, acts on the  $n$ th power  $X^n$  as permutation of coordinates. The set of all orbits of this action with quotient topology we denote by  $SP^n X$ . Thus, points of the space  $SP^n X$  are finite subsets (equivalence classes) of the product  $X^n$ . Thus two points  $(x_1, x_2, \dots, x_n), (y_1, y_2, \dots, y_n) \in X^n$  are considered to be equivalent if there is a permutation  $\sigma \in S_n$  such that  $y_i = x_{\sigma(i)}$ . The space  $SP^n X$  is called the  $n$ -permutation degree of a spaces  $X$  [1]. Equivalence relations by which we obtained spaces  $SP^n X$  and  $\exp_n X$ , is called the symmetric and hypersymmetric equivalence relations, respectively. Any symmetrically equivalent points  $X^n$  are hypersymmetrically equivalent. But inverse is not correct. So, for  $x \neq y$  points  $(x, x, y), (x, y, y) \in X^3$  are hypersymmetrically equivalent, but not symmetrically equivalent.

The concept of a permutation degree has generalizations. Let  $G$  be any subgroup of the group  $S_n$ . Then it also acts on  $X^n$  as group of permutations of coordinates. Consequently, it generates a  $G$ -symmetric equivalence relation on  $X^n$ . The quotient space of the product  $X^n$  under the  $G$ -symmetric equivalence relation, is called  $G$ -permutation degree of the space  $X$  and is denoted by  $SP_G^n X$ . An operation  $SP_G^n$  is also the covariant functor in the category of compacts and is said to be a functor of  $G$ -permutation degree. If  $G = S_n$  then  $SP_G^n = SP^n$ . If the group  $G$  consists only of unique element then  $SP_G^n X = X^n$ .