ALLAHVERDIYEV JALAL EYVAZ OGLU
(to 70th anniversary)

Allahverdiyev Jalal Eyvaz oglu was born on 17 September 1929 in Shusha town of Azerbaijan and he spent his childhood till 1946 there.

In 1946 he entered the physical-mathematical faculty of the Azerbaijan State University (ASU) which he graduated from in 1951. He left the secondary school with medal, and the University with diploma of honours.

J.E. Allahverdiyev's first works refer to his student years and they devoted to different problems of functional analysis and its application, particularly, to polyharmonic differential operators.

In 1951 J.E. Allahverdiyev entered postgraduation of ASU and soon went to Moscow with the aim to find a super visor for the candidate dissertation. After the conversation with academician MV.Keldish he was accepted to the Moscow State University (MSU) postgraduation passing exams only by his specialty. By academician M.V. Keldish's advise he began considering problems of completeness of systems of eigen and joined elements of non-adjoint operator bundles, i.e. oprators polynomially dependent on spectral parameter. Studying these problems he used M.V. Keldish's method where the essential element is the estimation of resolvent of such operators.

He found exact formula

$$\varepsilon_n(A) = \inf_{K \in K_n} \|A - K\| = \lambda_{n-1}\left[\left(AA^*\right)^{\frac{1}{2}}\right],$$

where A is a quite continuous operator acting in Hilbert space, K_n is a set of all finite dimensional operators with dimension n, and $\lambda_{n+1}\left[\left(AA^*\right)^{\frac{1}{2}}\right] - (n-1)$ is an eigen value of operator $\left(AA^*\right)^{\frac{1}{2}}$. This formula is remarkable by that $\inf_{K \in K_n} \|A - K\|$ has a sense on all spaces where one can determine the norm and finite dimensional operator. Using numbers $\varepsilon_n(A) = \inf_{K \in K_n} \|A - K\|$, by J.E. Allahverdiyev obtain the estimation of resolvent of operators polynomially dependent on spectral parameter in Hilbert and Banach spaces. In world reference the numbers $\varepsilon_n(A)$ are called s-numbers.

Further determining these numbers for polynomial operator functions he obtained estimations of resolvents of these operators in Hilbert and Banach spaces.

Because of his illness in 1953 he was out of the study in postgraduation for some time and revived it in 1954.

In 1956 he represented his candidate dissertation "On completeness of the system of eigen and joined functions of some classes of non-self-adjoint equations" and successfully defent it in 1957 in MSU named after M.V. Lomonosov.

The included by J.E. Allahverdiyev s-numbers were used in many works and his approach of determination of these numbers reduced to different definitions of s-numbers in Banach spaces.

Further by J.E. Allahverdiyev a wide class of the operators was studied, rational dependent on spectral parameter both in Hilbert and Banach spaces.

For estimation of resolvents of such operator functions the method worked out by himself was applied which uses the best approximations of operator with finite dimensional operators, and also the lemma proved by him and known now as J.E. Allahverdiyev's lemma.

Lemma. *Let H be Hilbert space and P be the projected operators of some subspace $H_1 = P(H)$, and linear operator K satisfies the condition $\|K-P\| < \varepsilon$, $\varepsilon < 1$. Then there exists subspace H_2 such that $H_2 \subset K(H)$ and operator Q ortoganally projecting on H_2 satisfies the condition*

$$\|P-Q\| < \varepsilon(1-\varepsilon)^{-1}.$$

This lemma found its application in many works and was given in some monographs.

The solution of equation $y = \lambda^n H_y$ for self-adjoint or even for normal operators H has n-systems of characteristic values if $\lambda_i^n = \mu_i$, where μ_i is a characteristic value of operator H, i.e. $\varphi_i = \mu_i H\varphi_i$. Consequently, λ_i is disintegrated into n systems satisfying equations: $\lambda_i^n = \mu_i$. J.E. Allahverdiyev was the first who established that analogous properties are kept for some weak perturbations of operator H.

By J.E. Allahverdiyev also included the new definition "derivative chains" for operators rationally dependent on spectral parameter. He proved that this definition for the operators polynomially dependent on spectral parameter is equivalent to the known Keldish's definition for these operator functions. By J.E. Allahverdiyev +
also new definition of n-multiple completeness of the system of elements was given not only for Hilbert and Banach spaces, but also essentially for any linear metrizable spaces. This definition is remarkable by the fact that n-multiple completeness of the system is connected with no operators, it is reffered to any system.

In 1962-1964 J.E. Allahverdiyev was in the Moscow State University with scientific mission and at the Institute of Mathematics of AS of USSR named after V.A. Steklov. In 1964 his Doctor dissertation "On eigen values and eigen elements of non-self-adjoined operators rational dependent on spectral parameter" was discussed at the Institute of Mathematics named after Steklov and suggested to defence.

In 1964 after return to Baku he worked as head of Calculated Center of AS of Azerbaijan. After foundation of Institute of Cybernetics of AS Azerbaijan Republic he was appointed the head of the department at this institute.

In 1968 J.E. Allahverdiyev successfully defent his Doctor dissertation at the Institute of Applied Mathematics of AS of USSR. On January 1969 he got the title of Professor.

In 1969 first he was appointed the deputy of director and in 1970- director of Institute of Cybernetics of AS of Azerbaijan and he was the director till 1988.

By J.E. Allahverdiyev the necessary and sufficient conditions of optimality of initial control for systems described by the differential- operator equation were obtained under the condition that the system of eigen and joined elements of operator bundle corresponding to the given equation forms n-multiple basis. Then these results were generalized for the case of differential-operator equations with delay.

By J.E. Allahverdiyev also the questions of the theory of optimal slippery regimes in the systems with distributed parameters and non-linear problems of control described by half-linear equations were investigated. In these works the widen problem is solved received from primary some operation of convexity. He was the first who gave the conceptions $S, G_a, G_a^1, G_c, G_c^1$ on stochastic systems control and the seperation theorems were proved for different conceptions on stochastic systems control with partial observations. One of the important results in this field obtained by J.E. Allahverdiyev is an analogue of Pontragin maximum principle for the problems of control by the systems with phase restrictions. Then evolutionary stochastic equations were studied. The necessary conditions of optimality of the first and second orders for stochastic systems of control and also further the necessary condition of optimality for abnormal problems were generalized for the stochastic systems in Banach spaces and the cases with controlled coefficients of diffusion were considered. In further works the problems of stochastic optimal control with delay argument were studied. The necessary conditions of optimality for these systems and also the new necessary condition of optimality for stochastic abnormal problems with delay for phase restrictions were obtained.

J.E. Allahverdiyev is a founder of school spectral theory of non-self-adjoined operators in Azerbaijan, which gave the great galaxy of mathematicians successfully developing this theory.

In 1988-1993 J.E. Allahverdiyev worked as projector by scientific work in Baku State University named after M.Rasul-zadeh. From 1993 to present day he is the head of chair "Investigations of operations and mathematical modelling" there.

In 1972 he was honoured to State prize of Azerbaijan. In 1972 he was ellected the member-correspondent of AS of Azerbaijan Republic.

Since 1981 he has been a honoured active worker of science. His articles have been published in prestige journals of former USSR and abroad. Much mathematicians in the world refer to his works. He took part at many International conference and symposiums (France, Yugoslavia, Turkey and Iran). He was a participant in World Congress of Mathematicians hold in 1966 in Moscow. He gave lectures in USA Universities (in 1975, a month), in Great Britain (in 1976, a month) and in Turkey (1993). More than 30 postgraduate students under his supervision successfully defent the candidate dissertation, some of his followers became Doctors of Science.

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