REVIEW

on the competition of taking the academic position "Professor" in professional
area 4.6 "Informatics and computer sciences" , speciality "Informatics",
announced in State Gazette issue 41 of May 21, 2019
with candidate: Vladimir Vasilev Monov, Associte Professor, PhD
Reviewer: Petko Hristov Petkov, Professor, DSc

1. General and biographical data

In the competition for obtaining the position "Professor" in "Informatics and computer
sciences", speciality "Informatics" at the Institute of Information and Communication
Technologies (IICT) of Bulgarian Academy of Sciences (BAS) - Sofia participates only one
candidate – Dr. Vladimir Vasilev Monov, Associate Professor in the Section "Modelling and
Optimization" of IICT. The candidate graduated from the Technical University of Sofia with
the speciality "Automatics and Systemtechnics" in 1982. In the period of 1984-1988 he was
PhD student in ITCR-BAS where he obtained the scientific degree "Doctor" (Candidate of
technical sciences) in 1988   with dissertation on the topic "Decentralized control of large-scale
linear systems". From 1984 to 1999 he was research associate at the Institute of Information
Technologies – BAS. From 1999 he is Associate Professor at IICT-BAS being a head of the
Section "Modelling and Optimization" from 2010. He has short specializations in Sweden in
2013 and 2014. He is fluent in English and Russian.

The competition is announced in State Gazette, issue 41 of May 21, 2019 based on a decision
of the Scientific Council of the IICT. The formal requirements in connection with the procedure
are fulfilled in the necessary time.

2. General description of the presented materials

The candidate participates in the competition with 25 works which do not repeat the works
presented to acquire the education and scientific degree "Doctor" and to occupy the academic
position "Associate Professor". Of these works, 14 are published at home and 11 – abroad.
One of the works is a Chapter of book published abroad, 4 are papers in foreign periodical
editions, 12 are papers in Bulgarian scientific journals, 8 are papers presented at international
scientific conferences, 2 of them at home and 6 abroad. One of the papers is coauthored by the
distinguished German specialist in the field of matrix analysis Prof. Ludvig Elsner. Eleven of
the publications are referred in Scopus and/or Web of Science. Six works are without co-
authors, 16 are with one co-author and the rest 3 – with 2 co-authors. Apart from this, the
candidate has 1 monography and 78 publications in journals and on conferences at home and
abroad, which are not presented in the present competition. A detailed reference is presented
for 66 citations of the candidate works, 30 of the citation publications being in editions which

are indexed and referred in Scopus and/or Web of Sciences. Documents are presented for participation in 13 scientific projects and contracts. An information is presented for reviewing of papers in 7 international journals. The candidate is a member of two scientific organizations and two editorial boards. There is no information about participation in organization or program committees of scientific meetings nor for reviewing procedures for obtaining scientific degrees or taking scientific positions.

3. General characteristic of the applicant's research, scientific and development activities

The candidate has a serious scientific research production, result of an active and steady work in the period 1986-2018. Assoc. Prof. Monov has serious scientific and application contributions in two important directions of Applied Mathematics and Informatics, namely the Theory of Matrices and the application of matrix analysis in the research of dynamic systems and processes, as well as in the modelling, analysis and optimization of information and communication systems. Apparent is a significant number of citations of his works by foreign authors. This characterizes Assoc. Prof. Monov as a researcher with significant scientific research and applied science activity.

4. Key scientific and applied science contributions

The works presented by the candidate are associated with the development of new methods in matrix analysis and modelling and optimization of information systems. The contents of these works shows that the candidate works continuously on the perfection of the approaches used and strive to extend the possible application areas. As most significant scientific and applied science contributions, I want to point out the following ones.

1. Scientific contributions

In the applicant's works are published serious results in the area of matrix analysis. Specifically, the following results are obtained.

In the area of matrix theory and matrix analysis:
- A criterion is proposed in work [30] characterizing the spectral set of given convex set of square matrices. The result obtained contains a theoretical contribution in the area of matrix analysis and may be used also as a criterion for robust stability of linear continuous-time and discrete-time systems with uncertain parameters.
- In work [33] the problem for existence and construction of non-trivial reducing spaces of square matrices is solved. An approach is proposed for construction of reducing spaces with the using of theoretical machinery of poly-linear algebra and specifically the exterior algebra, Grassman spaces and their vector representations. The result

obtained is applicable to the problem of reducibility of matrices and linear operators in different areas and especially in the area of linear control systems.

- In work [34] generalized Newton inequalities are proved, including the elementary symmetric functions of complex variables. The result obtained extends and generalizes significantly the classical Newton inequalities on the field of complex numbers. The results of this work have attracted interest and obtained further development in the works of prominent specialists in the area of inequalities and matrix analysis;

- In two of the papers results are presented containing contributions in the area of nonnegative matrices. In [35] are established properties of the derivatives of the characteristic polynomial of nonnegative matrices representing new results in the Perron-Frobenius theory. In [37] are proved sets of inequalities connecting functions of eigenvalues with the diagonal elements of nonnegative matrices. There are shown areas of possible applications of the results;

- In publication [36] are established and proved dependencies between the eigenvalues and diagonal elements of square elements with complex elements. A connection is established between the results obtained and a classical results of combinatorics, different applications are shown;

- In works [38] and [39] a formal mathematical machinery is developed for description and analysis of bilinear matrix products. A connection is established between these matrix products and special classes of matrices (associate and induced), as well as with the Kronecker product and standard matrix multiplication. Applications are shown in the bifurcation theory and Lyapunov stability theory;

- In work [36] assertion is justified and formulated, connected with non-negative matrices whose proof may lead to the solution of a difficult problem in the area of inverse eigenvalue problems.

In the area of modeling and optimization of information systems:

- In works [70], [71] and [72] a key problem in the theory of complex information systems for control of resources is investigated, related to preliminary estimation of the efficiency of the process of using and exploitation of such systems. The main scientific contribution of the investigation are the developed and described in publication [70] basic groups of criteria and estimation methods, as well as the whole methodology for analysis and preliminary assessment of the economic efficiency of the application of systems for resources control in small and medium-size enterprises;

- In publications [96] and [97] methods for optimization of topology and energy efficiency of wireless sensor nets are developed. In publication [96] an adaptive method for generation of sensor clusters is developed. In [97] a model of wireless sensor hub based on artificial neural net of the type of multilayer perceptron is developed. The

approach proposed allows efficient control of the energy consumption in the process of information transmission.

2. Science application contributions

- In work [44] a systematization is done of the models, methods, and control systems of technological processes of grinding in industrial globe mills. The mathematical models of the process are classified in two types: kinetic and energy model with corresponding differential equations, describing the material and energy balance during the process. Efficient control energies for the process are determined involving methods for decentralized multivariable and decoupling control, the using of PID-control and multivariable control;

- In work [50] a concept is proposed for development, design and production of prototype of combined tactile/voice interface facilitating and allowing the people having visual difficulties to work with computers, independently on the standard user interface or operation systems. For this aim a new electromagnetic actuation of the idles of Bryle display is developed, its construction is described, its characteristics are modeled and investigated;

- In work [57] an innovative nanotechnology is developed for renovation and substitution of the working surface of shafts used in the industrial production for extruding of nonmetallic sheets (plexiglass, PVC, packaging folio and so on). The technology is based on nonelectric laying of nickel covering with included nanoparticles. Results are presented and analyzed from the experimental tests of the innovative technology with nanostructured nickel covers;

- In work [58] a mechatronic rehabilitation system is presented having intelligent functions and capabilities to realize passive as well as active rehabilitation. The system tracks the patient reactions and uses feedback in real time. The mechanical and electrical components of the system and its main regimes are described as well as the necessary medical and technical activities for its implementation.

- In work [74] six algorithms are proposed for optimization of production schedules in industrial enterprises. The algorithms minimize the working time of production capacities solving tasks under the conditions of different production constraints and objective functions. The algorithms are implemented as software modules in the programming environment of MATLAB program. The user interface developed combines in an unified program system algorithms for stock control and algorithms for optimization of production schedules.

Other significant results are achieved that are presented in detail in the author contribution reference which I accept entirely.

5. Significance of the contributions to science and practice

The results in the area of matrix theory and matrix analysis, obtained by the applicant, represent serious scientific contribution and have application in different fields as the linear control system theory and optimization of information systems. As already noted in Sect. 2, the applicant's works are cited 66 times which makes reasonable to think that the contributions of Assoc. Prof. Monov obtained the necessary recognition by the scientific community at home and abroad.

6. Evolution of teaching capabilities and activities of the applicant

There is no information about lectures presented by the applicant. He has conducted successfully one PhD student.

7. Critical remarks and recommendations

There is a relatively small number of applicant publications in foreign journals. The high level of several results obtained makes reasonable to recommend their wider publication in edition with impact factor. Also, it is appropriate to recommend a preparation of a monograph in English in the area of matrix analysis so that the results may obtain wider recognition by the scientific community.

8. Personal impressions and opinion of the reviewer

I know the candidate from the period of his education in the Technical University of Sofia. I am impressed by the large volume of scientific and applied science activity, done after his habilitation in 1999. I have very good impressions from the way in which he presents his scientific results and forms his conclusions. I think that there are very good prerequisites for his future work.

9. Fulfilment of the minimum state criteria

I declare the fulfilment of the normative requirements in respect to the national and institutional scientific data for the area "Natural sciences, Mathematica and Informatics" to occupy the position "Professor" by group of indicators as follows: A = 50 points, B = 100 points, G = 260 points, D = 140 points, E = 150 points.

CONCLUSION

The serious scientific and science application contributions of the candidate, their publication in prestigious international editions at home and abroad and the large number of citations of the work make me convinced to propose Assoc. Prof. Valdimir Vasilev Monov to take the academic position of "Professor" in the professional area "Informatics and computer sciences", speciality "Informatics".

18.09.2019

Reviewer:

/Prof. Petko Petkov, DSc,
Technical University of Sofia/

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