

O P I N I O N

on a competition for the academic position of "professor",
Field of higher education 5. Technical sciences,
Professional direction 5.2 "Electrical engineering, electronics and automation",
Scientific specialty "Application of the principles and methods of cybernetics in various
fields of science"

Announced in SG No. 95/14.11. 2023

For the needs of the "Intelligent Systems" section of IICT-BAS

Candidate: associate professor Dr. Vera Angelova Angelova-Dimitrova

Jury member: Prof. Dr. Dimitar Karastoyanov - IICT - BAS

Reason: order No. 7/10.01.2024 of the Director of IICT-BAS,

Only one candidate submitted documents for the announced competition - associate professor Dr. Vera Angelova Angelova-Dimitrova.

1. General description of the presented materials

Associate Professor V. Angelova graduated from TU-Sofia as an automation engineer. She has been a doctor since 1995 and an associate professor since 2005.

A service memo is presented regarding a total of 34 years of work experience, of which 19 years as an associate professor.

2. General characteristics of the scientific and scientific-applied activity

28 scientific publications are presented in the competition, that did not participate in its procedure for "doctor" and the competition for "associate professor". All publications are in English. Of them, 5 are independent [Г4, Г9, Г10, Г11, Г13].

Of the publications for the competition, 17 are in journals with an impact factor (IF): [B1] – [B10], [Г2 – Г5], [Г7], [Г8], [Г14]; 7 are in journals with SJR [Г1], [Г6], [Г9] - [Г13].

According to the publications presented for the competition, the scientific interests of Prof. V. Angelova are in the main direction:

Conditionality and sensitivity of matrix equations [B1 - B10, Г1 - Г3, Г5 - Г11, Г13, Г15 - Г18].

There are other publications in the fields of Soft Computing [Г4] and Personality and Behavior in Electronic Commerce [Г12, Г14].

3. Analysis of scientific and scientific-applied achievements according to the materials

Prof. Angelova's scientific interests are related to solving tasks from the theory of linear control systems - perturbation analysis of matrix equations and sensitivity of the solution to data disturbances.

Prof. Angelova develops approaches based on Fréchet derivatives for deriving first-order condition numbers and perturbation limits. Derives local and non-local perturbation bounds by applying the method of equivalent operators.

CONTRIBUTIONS

I accept the contributions claimed by the applicant, which can be grouped as follows:

SCIENTIFIC CONTRIBUTIONS

Conditionality and sensitivity of matrix equations

1. Application of the method of Lyapunov majorants and fixed point principles to obtain nonlocal nonlinear error bounds, (the distance between the approximate solution of the nonsymmetric Riccati differential equation in a reduced-dimensional space to the exact solution of the unscaled equation of full rank) [B8].
2. Two approaches of nonlocal perturbation analysis are proposed to study the sensitivity of the solution to perturbations in the matrix coefficients and the initial state in a nonsymmetric Riccati differential equation [B9]. Nonsymmetric Riccati differential equations are related to linear boundary value problems in game theory, control theory, calculus of variations, theory of transport processes.
3. For the needs of the experimental analysis of perturbation limits known in the literature of Riccati's symmetric differential matrix equation, its analytical solution was derived and proved [B10]. The resulting analytical solution of the equation is used in tasks related to solving Riccati's differential equation.
4. An analytical expression of the first Fréchet derivative of the function $A \rightarrow A^p$ at the point A at $p=1/s$ is derived, where s is a natural number [Γ5]. The result has 16 citations. As a continuation of [Γ5], absolute and relative norm, mixed and component numbers of conditionality of the equation [Γ8] were formulated.
5. The perturbation analysis approach was developed for problems with a singular operator matrix [Γ2]. The result is original, because for a singular operator matrix the techniques of local perturbation analysis are inapplicable because there is no inverse matrix of the singular matrix. Therefore, no solution error equation can be obtained. A development of the standard perturbation analysis technique is proposed as it is extended to the case of a singular operator matrix [Γ2].
6. New original absolute and relative condition numbers, asymptotic and non-local upper bounds on round-off errors and upper bounds on the residual error in solutions of matrix equations from control theory and other fields are derived [B1 – B7], [B9], [Γ1], [Γ3], [Γ6 – Γ11], [Γ13], [Γ17], [Γ18]. Exact expressions for norm, component-wise and mixed absolute and relative condition numbers of a complex matrix equation and first-order bounds for the perturbations in the computational solution are derived. An analysis of the effectiveness of the perturbation boundaries was made. A norm non-local bound on the residual error in the computed by an iterative algorithm is derived. An analysis of the effectiveness and accuracy of existing methods for evaluating the sensitivity of the solution with respect to the perturbation limits was performed. Exact expressions for norm, component and mixed absolute and relative condition numbers of the fourth type of complex nonlinear matrix equation are derived. The same approach has been applied to a perturbation analysis of a stochastic Riccati matrix equation with an application in finance. An iterative algorithm for bounding the residual error in the approximate solution for a fifth type of nonlinear complex matrix equation is developed. Determining the residual error bound with the same approach is done for the sixth and seventh types of complex matrix equation. Perturbation analysis has been used to find norm, mixed, and component condition numbers and based on them easily computable local bounds, as well as norm nonlocal residual bounds for solutions of nonlinear matrix equations of the eighth to twelfth type.

SCIENTIFIC APPLIED CONTRIBUTIONS

Personality and behavior in e-commerce

Psychological links in consumer behavior in the field of e-commerce (emotional stability, consumer risk aversion) have been studied [Г12, Г14]. The relationship between emotional stability and consumer risk awareness on the one hand and some observed basic functionalities of online stores on the other hand was confirmed. Two regression models in the field of machine learning have been synthesized in order to predict user preferences in online shopping.

I positively assess the candidate's scientific and applied scientific contributions in the presented research areas.

4. Citations

A list of 130 citations of all the applicant's publications is attached. The citations of the publications from the competition are 106. Of the citing publications, 70 are in indexed/referenced in Scopus and/or Web of Science editions.

5. Fulfillment of the minimum requirements and other activities

Prof. Angelova exceeds the minimum requirements for the academic position of "professor" according to the Law on the development of the academic staff in the Republic of Bulgaria, the Rules for its application and the Rules of the IICT. According to the IICT Regulations, the requirements and **performance** by Prof. Angelova for the individual indicators are as follows:

A - 50/50; B - 100/240; Г - 220/ 338.3; Д - 120/866; E - 150/250.

Prof. Angelova has published 5 university textbooks and teaching aids.

24 publications are visible in Scopus and its H-index is 5.

Prof. Angelova has participated in 1 international and 4 national projects.

Prof. Angelova has been an associate professor in the "Intelligent Systems" section since 2010. She has PhD Student defended in 2021.

He teaches (in French) at the French Faculty of TU-Sofia and Sofia University, "Fundamentals of Statistics" and "Applied Statistics".

Prof. Angelova has an active administrative and organizational activity - until now she is the scientific secretary of IICT; from 2020 until now he is a member of the General Assembly of the BAS;

He is a member of the editorial board of 3 journals: "Cybernetics and Information Technologies" with IF/SJR; Lecture Notes in Computer Science and Technologies of IICT-BAS, ISSN 2367-8666; Journal of Information Technology and Control, ISSN 1312-2622.

Conclusion

Based on the presented materials, the stated scientific and scientific-applied contributions, as well as the comprehensive evaluation of the other indicators of the competition, I give a positive assessment to the candidate and recommend the Honorable Scientific Jury to propose to the Scientific Council of IICT-BAS to elect Associate Professor Dr. Vera Angelova Angelova-Dimitrova for the academic position "Professor" for the needs of the "Intelligent Systems" section at IICT - BAS, professional direction 5.2 "Electrical engineering, electronics and automation", scientific specialty "Application of the principles and methods of cybernetics in various fields of science".

19.02.2024

Member of the Scie
(Pr

НА ОСНОВАНИЕ

331A