

## Review

for associate professor Pencho Marinov  
in the competition for academic position "Professor"  
in the professional field 4.5 "Mathematics"  
scientific specialty "Mathematical modeling and application of mathematics "

Reviewer: Prof. Stefka Fidanova

By Order No. 241 dated 01.10.2019 of the Director of Institute of Information and Communication Technologies at Bulgarian Academy of Sciences, Prof. Galia Angelova, pursuant to Art. 4, para. 2 of the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB) and decision of the Scientific Council of IICT-BAS (Minutes No. 8 of 25.09.2019) I have been appointed a member of the scientific jury under the procedure for the academic position of "Professor" in the professional field 4.5 "Mathematics" scientific specialty "Mathematical modeling and application of mathematics", announced for the "Parallel Algorithms" section of State Gazette issue 59 of 26.07.2019. As a member of the jury on 08.10.2019 I have received all the documents, attached to the application to the Director of IICT-BAS of the only candidate for the competition Assoc. Prof. Pencho Marinov.

According to Law on the Development of Academic Staff in the Republic of Bulgaria, the rules for its implementation and the specific requirements introduced in the regulations of IICT-BAS, applicants must meet the following requirements:

1. Have acquired a doctorate degree in education and science;
2. Have held the academic position of "Associate Professor" at the same or another higher education institution or scientific organization for at least two academic years;
3. Have submitted published monographs or equivalent publications in specialized scientific editions which do not repeat the ones submitted for the degree of PhD, the Doctor of Sciences and the academic position of Associate Professor;
4. Have submitted other original research papers, publications, inventions and other scientific and applied research works which are evaluated in aggregate;

5. Meet the national minimum requirements;
6. Not to have the lawful plagiarism proven in scientific works.

Associate Professor Pencho Marinov holds a dissertation for educational and scientific degree "Doctor" (HAC to the Council of Ministers, diploma № 23033/21.04.1994, commission 1, protocol № 2 of 01.02.1994) based on dissertation titled "Approximation algorithms with rational functions with respect to Hausdorff distance".

Pencho Marinov holds the academic position of Associate Professor, HAC to the Council of Ministers, diploma № 20652/21.05.2001, commission 1, protocol № 5 of 16.03.2001. Associate Professor Pencho Marinov has 40 years of total work experience, of which 18 years as associate professor.

For Group B requirements, Pencho Marinov submitted 7 publications. All of them are published in the Journal „Advances in Space Research“, which has an impact factor and in different years was in Q1, Q2 and Q3. Thus 3 of the publications are in Q1, 2 are in Q2 and 2 are in Q3. The total score was 290 at the required 100.

For Group Г indicators, a total of 26 publications are presented, all of them are Impact Ranks, 3 are in Q1, 8 are in Q2, 11 are in Q3, 4 are in Q4. The total number of points is 896 for the required 260. Associate Professor Pencho Marinov submitted 143 citations after acquiring the academic position of Associate Professor visible in WoS / SCOPUS. The total number of points is 858 for the required 140 under indicator Д. According to SCOPUS he has a total 364 citations to his publications and index  $h=10$  excluding autocitations.

Associate Professor Pencho Marinov was the co-supervisor of one successfully defended PhD student. He was the head of 2 national scientific projects. He was a member of the scientific team of 9 international projects and 8 national projects. The total number of points is 326 for the required 150 under indicator E.

Associate Professor Pencho Marinov exceeds the national requirements, as well as the specific requirements of BAS and IICT for the academic position of "professor".

Most of the presented works by Assoc. Prof. Pencho Marinov are related to the development of models and algorithms for space physics problems. A model of the distribution of the electron temperature at high altitudes (1000 - 10000 km) and at low altitude (600 km) has been made. The transition between different states is described by cubic splines. A model of ionospheric phenomena has been developed based on vertical electron density profiles. The model describes the height of a vertical plasma scale with a multidimensional polynomial consisting of Chebyshev and

trigonometric basis functions that are fitted to data in a 5-dimensional space. A three-dimensional model for studying ionospheric structures has been developed. The disturbances in ion density and temperature in the morning peak ionosphere caused by low latitude seismic activity were investigated. The relationship between ionospheric disturbances and seismic activity has been established.

Another area of work is the modeling of device for thermonuclear fusion with magnetic hold of the plasma. Magnetic resonance interference have the effect of mitigating turbulent phenomena within certain limits.

Work has also been done in the field of epilepsy phase modeling. A discrete Fourier transform was used for this purpose. The model enables analysis and comparison of the different phases of epileptic seizures.

The wide variety of oncology and immunological disorders is characterized by differential scanning calorimetry (DSC) for obtaining characteristic thermodynamic profiles. The approach of intercriteria analysis, combined with correlation analysis, is applied to a large number of data of patients diagnosed with multiple myeloma (MM). Dependencies that are common to different types of MM have been identified and they can be considered as major characteristics of the disease. A class of methods for solving a given type of algebraic systems based on the best uniform rational approximation of a certain scalar function in a single interval is analyzed numerically.

The main contributions to his research can be summarized as follows:

**1. Models and algorithms for solving problems in space physics have been developed. (24 publications)**

Cubic splines have been used to model the distribution of electronic temperature, both at high (over 1000 km) and at smaller (up to 600 km) altitudes. The ionospheric phenomena are modeled using Chebishev and trigonometric basis functions. The model is three-dimensional and uses vertical electron density profiles as data. With this model, smaller scale phenomena can be separated from larger ones.

The disturbances in ion density and temperature in the morning peak ionosphere caused by low latitude seismic activity have been modeled and investigated.

**2. A model of device for thermonuclear fusion with magnetic hold of the plasma is developed (2 publications)**

A reactor for thermonuclear fusion with magnetic hold of the plasma is modeled. The aim is to find the magnetic field parameters to effectively control the plasma in the reactor and prevent it from touching the walls of the reactor. The effect of impurities such as nitrogen and others injected at low concentrations on the plasma temperature on the edges was investigated.

**3. A model describing the individual phases of an epileptic fit has been created. (2 publications)**

A method has been developed for the fine division of brain signals in epileptic seizures. A discrete Fourier transform was used for this purpose. This makes it possible to study and model the various phases of an epileptic fit. Tests were performed on two breeds of rats. A comparison of the records of their seizure activity was made.

**4. Dependencies have been found that are common to different types of multiple myeloma. (1 publication)**

Intercriteria analysis is a type of correlation analysis that uses intuitionistic fuzzy sets and gives more detailed characteristics than traditional correlation analysis. It also introduces an element of uncertainty. A combination and comparison of intercritical and correlation analysis were made, which were applied to data on patients with multiple myeloma (MM). Dependencies that are common to different types of MM have been identified. This allows them to be considered as the main characteristics of this disease. This result may help better diagnosis.

**5. The best uniform rational approximation of a function of one variable in the unit interval is made. (1 publication)**

Two methods are proposed for solving a certain type of algebraic system. Both methods are based on a uniform rational approximation of URA and BURA. URA has been theoretically proven to maintain the positiveness of the approximation, which means that if the right side is positive, then the numerical solution is also positive. BURA has the same effect but has not been theoretically proven. The tests showed a 20-fold improvement in accuracy compared to other methods.

**Critical notes:** The materials presented are not well designed, especially abstracts of publications and contributions. Most of all, this concerns the reference to contributions. The contributions are not well defined. The use of grid infrastructure cannot be a contribution, nor is it a "brain data processing task" or an "Task from the field of intercritical analysis". The contribution is the model that was made, the method developed, the conclusions drawn as a result of the analysis of the results obtained.

## CONCLUSION

According to the presented documents, the candidate Assoc. Prof. Pencho Marinov fulfills all the requirements of the LDASRB, of its Rules of Procedure and of the Rules on the Specific Requirements for Acquisition of Academic Degrees and Occupation of Academic Positions of BAS and IICT-BAS. I give a positive conclusion for the selection of Associate Professor Pencho Marinov in the competition for the academic position of "Professor" in the professional field 4.5 "Mathematics" scientific specialty "Mathematical modeling and application of mathematics".

I propose that the Scientific Jury unanimously vote on a proposal to the Scientific Council of the Institute of Information and Communication Technologies of the Bulgarian Academy of Sciences to select Assoc. Prof. Pencho Marinov for the academic position of "Professor" in the professional field 4.5 "Mathematics" scientific specialty "Mathematical modeling and application of mathematics. "

01.11.2019

