REVIEW

in a competition for an academic position

"Associate Professor"

in professional field 5.3 Communication and computer equipment,

for the needs of Sofia University "St. Kliment Ohridski "(Sofia University),

Faculty of Physics, announced in SG no. 21 of 15.03.202.

The review was prepared by: Prof. Dr. Petar Stoyanov Apostolov, Southwestern University "Neofit Rilski" - Blagoevgrad, in his capacity as a member of the scientific jury of the competition according to Order № RD -38-198 / 27.04.2022 of the Rector of Sofia University.

Only a candidate has submitted documents for participation in the announced competition: Ch. Assistant, Hristomir Hristov Yordanov, PhD, Technical University - Sofia, Faculty of Telecommunications, Department of Technology and Management of Communication Systems.

I. General description of the presented materials

2. Details of the procedure

The documents submitted by the competition by the candidate comply with the requirements of law, university regulations, and the Regulations on the terms and conditions for acquiring scientific degrees and holding academic positions at Sofia University "St. Kliment Ohridski".

For participation in the competition, the candidate Hristomir Hristov Yordanov presented a list of a total of 23 titles in foreign scientific journals and scientific forums. 19 other documents are also presented, satisfying the requirements of Regulations on the terms and conditions for acquiring scientific degrees and holding academic positions at Sofia University "St. Kliment Ohridski for participation in the competition.

9. Candidate details

Hristomir Hristov Yordanov was born on October 28, 1979 in the city of Sofia.

2.1. Education:

- 1998 American College in Sofia;

- 1998 - 2002 Technical University, Sofia, Faculty of Telecommunications, Bachelor's degree;

- 2004 - 2006 Institute of High Frequency Engineering at the Technical University of Munich, Germany, Master's degree;

- In 2011 he defended his educational and scientific degree "Doctor" at the Technical University of Munich, Germany.

2.2. Work activity:

- 2000 - 2004 company ElkoStar EOOD, Sofia, design engineer;

- 2005 EADS, GmbH Ottobrun Germany, working student;

- 2005 - 2006 Institute of High Frequency Engineering at the Technical University of Munich, working student;

- 2006 - 2010 Institute of High Frequency Engineering at the Technical University of Munich, working student;

- 2011 Project Laboratories, Electronics Engineer;

- 2014 - 2016. Technical University - Sofia, Faculty of Telecommunications, Department of Radio Engineering and Video Technology, Assistant;

- 2011 - 2015. Research sector at the Technical University - Sofia, research engineer;

- 2017 - now. Technical University - Sofia, Faculty of Telecommunications, Department of Technology and Management of Communication Systems, Chief Assistant;

- 2019 - 2020 Berkeley Wireless Research Center, UK, guest researcher under the Fulbright program.

10. General characteristics of the scientific works and achievements of the candidate

From the materials presented to me, I can confidently say that engineer Hristomir Yordanov, PhD is a proven specialist in the field of communication and computer technology. Knowledge and developments are at a high scientific and technological level in the design of digital circuits, wireless sensors and sensor networks, development of simulation software for

microwave technology, measuring equipment, signal processing with artificial intelligence systems.

The candidate uses the most commonly used computer operating systems, as well as a number of development environments, CAD programs for microwave design and microwave hardware. The use of English, German and Russian expands the candidate's creative and scientific vision.

The scientific results have been published in prestigious scientific journals and conferences at home and abroad. The usefulness and innovation of the scientific achievements have been confirmed by two patents: BG2305 (U1) - Radiometer with switching high-frequency amplifiers and DE102009018880 (A1) - Anordnung zur drahtlosen Informationsübertragung zwischen integrierten Schaltkreisen und / oder Shall.

In general, the scientific works and achievements of the candidate meet the minimum national requirements (under Art. 2b, para. 2 and 3 of law) for holding the academic position of "Associate Professor" in the scientific field of Technical Sciences, professional field 5.3 Communication and Computer Engineering.

The scientific papers submitted by the candidate do not repeat those of previous procedures for acquiring a scientific title and academic position.

There is no legally proven plagiarism in the scientific papers submitted at the competition.

11. Characteristics and evaluation of the teaching activity of the candidate

The candidate has nearly 8 years of work experience on a permanent employment contract as an assistant and chief assistant at the Faculty of Telecommunications and the Faculty of German Engineering Training and Industrial Management at the Technical University in Sofia. Lectures and exercises are in German with hours in accordance with the curriculum. As a guest lecturer, Dr. Hristomir Yordanov has lectured on Theory and Practice of Antennas at the Berkeley Wireless Research Center - UK, which is a prestigious international recognition for the teaching activities of the candidate.

12. Substantive analysis of the scientific and scientific-applied achievements of the candidate contained in the materials for participation in the competition

From the submitted documents several directions in the research activity of the candidate can be determined.

12.1. Application of numerical methods for modeling electromagnetic fields in optimization problems.

In publication G1. Using YATPAC for Modeling of a Marchand Balun is described a method for complete electromagnetic simulation, created at the Technical University of Munich. The method is based on matrix analysis of connected lines with distributed parameters. An example of a simulation of a Marchand balun-transformer is demonstrated. The candidate's contribution is in the creation of algorithms for visualization of three-dimensional electromagnetic fields in the time domain, processing of electromagnetic signals, as well as genetic algorithms for optimization of circuits with distributed parameters. The speed of the simulation process was also studied. The comparison of the obtained results with the known simulation programs CST Studio and ADS show a very good match, which proves the applicability of the proposed electromagnetic simulator.

12.2. Electromagnetic communication link in, and between integrated circuits

In his dissertation G2. Wired and Wireless Inter-Chip and Intra-Chip Communications, the candidate demonstrates an in-depth research approach in solving the set tasks. The dissertation is a model of German accuracy. The research and results of the dissertation are published in a scientific monograph with the same title in German.

The research is oriented in two directions:

Optimization of communication in, and between integrated circuits. The Christofel-Schwartz method was used to determine the parasitic parameters of the busbars in an integrated circuit. It is known that in such communication the parasitic parameters degrade the information transfer rate and the BER (Bit Error Rate) ratio. In this regard, methods have been proposed to optimize coding against errors.

In 2010, the results were co-authored as part of a review article Nanoelectronics-Based Integrated Antennas, published in two high impact factor journals: IEEE Microwave Magazine and IEEE Antennas and Propagation Magazine.

Investigation of chip-integrated antennas for wireless communication between integrated circuits.

The candidate has explored the possibility of using the busbars of the DC power supply and the grounding of the integrated circuits as radiating elements. This is a very complex and ambitious idea, as the DC power supply must be well filtered so as not to disturb the stability

of the operation of integrated circuits. In this regard, the Christophel-Schwartz method for determining the parasitic parameters of the rails, as well as the numerical methods for reducing BER give encouraging results.

Another technical way to integrate an antenna into a chip is to develop methods for manufacturing antennas on high-impedance silicon pads. The idea is to reduce the losses in the pad. The theory and practical results are described in G4 - Monolithic Integrated Antennas with High Radiation Efficiency, conference report, and D1 - On-Chip Monolithic Integrated Antennas Using CMOS Ground Supply Planes, an article in a scientific journal with a high impact factor.

12.3. Studies of miniature integrated antennas

The use of high-impedance silicon pads to reduce losses when integrating an antenna into a chip is difficult to apply in microelectronics. For this reason, the candidate has focused on the study of integrated antennas on ultra-thin pads. In publications G5. Design and prototyping of radiation- and area-efficient monolithic integrated antennas, G6. High Efficiency Integrated Antennas on Ultra-Thin Si Substrate and G7. On-Chip Integrated Antennas on Ultra-Thin and on High-Impedance Si Substrate are proposed experimental prototypes of this type of antennas, with the corresponding simulation and experimental results. Particular attention is paid to methods to reduce losses.

Another area of research in this area is the reduction of interference due to digital information signals in the conductive busbars of the chip. A model for experimental determination of interference, as well as measurements of their levels in the integrated antenna is presented. The results are published in B8. Digital Interference in Monolithic Integrated Antennas and G8. An Experimental Setup for Switching Noise Measurement in Monolithic On-Chip Antennas.

In summary, the scientific contributions in this direction are published in B7. Maximizing Throughput in Chip-to-Chip Communications, D1. On-Chip Monolithic Integrated Antennas Using CMOS Ground Supply Planes. It is worth noting that D1 was published in a prestigious scientific journal with a high impact factor - IEEE Transactions on Components, Packaging and Manufacturing Technology.

The idea of using ultra-thin silicon pads with ChipFilm™ technology is an ingenious engineering solution that leads to a significant improvement of the parameters compared to the integrated antennas on high-impedance substrates.

In a number of publications, the candidate has focused his research on the development of equivalent circuits with focused parameters for electromagnetic structures with distributed parameters based on their S and Z parameters. This approach is appropriate in the design of antenna systems and microwave elements. The equivalent circuit with focused parameters allows the use of SPICE simulators, which can determine the "critical" for the setting elements and optimize the parameters of the designed product. This is significantly faster than full electromagnetic simulations and greatly simplifies design. The results published in B2 are impressive. Generation of Network Models for Planar Microwave Circuits by System Identification Methods, B5. Combined lumped element network and transmission line synthesis for passive microwave structures, and G3. Equivalent Circuit Models for Linear Reciprocal Lossy Distributed Microwave Two-Ports.

12.4. Research in the field of measuring technology

The main task of engineering work is the implementation of modern scientific and technical achievements in practical tasks. In collaboration with representatives of the industry, Eng. Dr. Hristomir Yordanov develops devices for measuring moisture in bulk materials. In this regard, methods have been developed for calibration of hygrometers for bulk materials, based on the interaction between electromagnetic waves and inert materials, with compensation of the density of the test material.

In publication B9. Calibration Techniques for Microwave Moisture Meters, the candidate offers a technological way to compare the uncertainty of different measurement methods.

12.5. Signal processing with artificial intelligence systems

In his publications, the candidate demonstrates interests in a wide range of scientific fields. The G9 articles support this. Neural Networks for Scattering Signal Based Object Recognition and G10. Object Recognition Using Neural Networks and Complex Reflection Signals. This is a promising area for signal processing with artificial intelligence systems. The aim of the research is to develop and apply methods based on neural networks that recognize the geometric shape of objects by means of a reflected radar signal. Models of objects with cube and sphere shapes have been created and the reflected signals during radar irradiation have been studied. In this direction, neural networks have been developed to recognize the shape of the object. A comparison of the efficiency of neural networks depending on the parameters of the reflected radar signal is made.

12.6. Methods for measuring and calibrating phased array antennas

The candidate is a research supervisor of a doctoral student. The topic of research is methods for measuring and calibrating phased array antennas. The fruitful cooperation with the company RaySat, Bulgaria allows the use of modern measuring instruments, and the scientific results are beneficial to the applied activity of the company. The results obtained so far are reflected in G11 publications. Phased Antenna Array Cross-Polarization Tuning and G12. Method for Antenna and Probe Alignment in a Near-Field Test Setup.

Of interest is the publication B1 - Arrays of Isotropic Radiators - A Field-theoretic Justification. The design of linear equidistant antenna arrays (LEARs) comes down to determining the array factor, which assumes that the antenna system consists of isotropic point radiators. These are non dimensionless objects that radiate uniform into the surrounding space with equal amplitude and phase as the radiation diagram has the shape of a sphere. The real radiation diagram of LEAR is obtained by the Multiplication Theorem: The Array Factor diagram × the real radiator diagram.

The authors use Hertz dipoles as real radiators. Insofar as in the case of vertical arrangement the dipole has a radiation pattern of a circle in azimuth, then the pattern of orientation of LEAR in shape will coincide with the array factor. The useful effect in the publication is the study of the mutual coupling of dipoles, which is inevitable in real conditions. The derived equation for the function $\Psi(x)$ (22), the comparison with the Bessel function $J_0(x)$ in Fig. 2, as well as the results of the LEAR gain simulations in Fig. 3, are a useful contribution to the synthesis of linear equidistant antenna arrays.

13. Critical remarks and recommendations

From the materials provided to me, I am left with the impression that Eng. Hristomir Yordanov, PhD is a highly qualified specialist in the scientific field 5.3 Communication and computer technology. His scientific achievements have been published in world-renowned scientific journals and reported at international conferences with high prestige. The candidate's achievements in the scientific and practical field are impressive.

In my opinion, it is desirable for these scientific results to be published in Bulgarian for one simple reason: the native language of students, doctoral students and teachers in our country is Bulgarian. I would recommend that the review article D1 be translated and published in an appropriate Bulgarian-language magazine in our country, which will lead to their popularization.

14. Personal impressions of the candidate

I have no personal impressions of the candidate.

15. Conclusion on the candidature

After getting acquainted with the materials and scientific works presented in the competition and on the basis of the analysis of their significance and the scientific and scientific-applied contributions contained in them, I confirm that the scientific achievements meet the requirements of law, the Regulations for its application and the respective Regulations of Sofia University "St. Kliment Ohridski "for the candidate for the academic position" Associate Professor "in the scientific field 5.3 Communication and Computer Engineering. In particular, the candidate satisfies the minimum national requirements in the professional field and no plagiarism has been established in the scientific papers submitted at the competition.

I give my positive assessment of the candidacy.

II. OVERALL CONCLUSION

Based on the above, I recommend the scientific jury to propose to the competent authority for the selection of the Faculty of Mathematics and Informatics at Sofia University "St. Kliment Ohridski" to elect Eng. Hristomir Hristov Yordanov, PhD to take the academic position of "Associate Professor" in the professional field 5.3 Communication and Computer Engineering.

25. 06. 2022 г.

Reviewer: .....

(prof. ScD Peter Apostolov)