# OPINION

**by Prof. Dr. Hristo Stefanov Kiskinov, PhD,**

**Professor at Plovdiv University "Paisii Hilendarski" (PU),**

**Faculty of Mathematics and Informatics**

of a dissertation for the award of the educational and scientific degree **"Doctor" (PhD)**
by: Area of Higher Education 4. *Natural Sciences, Mathematics and Informatics*;
Professional Field 4.5. *Mathematics;*
Doctoral Program *Mathematical Analysis*.

**Author:** Plamena Ivanova Marcheva.
**Title:** "Fixed Points and Convergence of Iterative Methods for Simultaneous Approximation of Polynomial Zeros"
**Scientific Ssupervisors:** Prof. Petko Dimitrov Proinov, DSc and Assoc. Prof. Stoil Ivanov Ivanov, PhD.

## 1. General Presentation of the Procedure and the PhD Student

By order No. PD-21-431 from 23.02.2023 of the Rector of the Plovdiv University "Paisiy Hilendarski" (PU), I have been appointed as a member of the scientific jury to ensure a procedure for the defense of a dissertation titled "Fixed Points and Convergence of Iterative Methods for Simultaneous Approximation of Polynomial Zeros" for awarding the educational and scientific degree "doctor" in the area of higher education *4. Natural sciences, mathematics and informatics*, professional field *4.5 Mathematics*, doctoral program *Mathematical analysis*. The author of the dissertation is Plamena Ivanova Marcheva - full-time PhD student at the Mathematical Analysis Department of the Faculty of Mathematics and Informatics (FMI) at Plovdiv University Paisiy Hilendarski with scientific supervisors Prof. Petko Dimitrov Proynov, DSc, and Assoc. Prof. Stoil Ivanov Ivanov, PhD.

The set of paper and electronic materials presented by the PhD student Plamena Ivanova Marcheva is in full compliance with Article 36 (4) of the Regulations for the Development of the Academic Staff of the PU and includes all the necessary documents.

Plamena Ivanova Marcheva was born on 04/04/1985. In 2017, she obtained a bachelor's degree in "Engineering Physics" at the "Paisii Hilendarski" Polytechnic University, and in 2019 she obtained a "master's" degree with a "Mathematics" specialty again at the Polytechnic University. In 2015-2016, she acquired a qualification as a mathematics teacher, and from 2017 to 2019, she worked as such at "Chernorizets Hrabar" Secondary School in the city of Plovdiv. Since 2019, he has been a full-time PhD student at the Department of Mathematical Analysis at the FMI at the PU.

## 2. Actuality of the Research Topic

The study of the convergence of iterative methods for approximating of polynomial zeros using fixed point theory is an evergreen topic in mathematics. It is still relevant today, which is easily established by following the publication activity of those working on this topic in specialized journals.

## 3. Knowing the Problem

The carried out review of scientific research on the problem, the selected literature and above all the obtained results speak unequivocally of deep knowledge in the researched field.

## 4. Research Methodology

The methodology of the research is standard for many mathematical studies – proving statements, constructing methods based on the proven statements, their numerical implementation and presentation of illustrative examples.

## 5. Characterization and Evaluation of the Dissertation Work and Contributions - Presence/Absence of Plagiarism

The dissertation "Fixed Points and Convergence of Iterative Methods for Simultaneous Approximation of Polynomial Zeros" is written on 117 pages and consists of an introduction, four chapters, a conclusion and a bibliography of 108 titles. In the introduction, in addition to formulating the goals and tasks, some more significant results for local and semi-local convergence of simultaneous methods are presented, which are directly related to the topic of the present dissertation work. The first chapter has an overview character and is dedicated to the general theory of convergence of iterative processes in cone normed spaces, introduced by the scientific supervisor Prof. Petko Proinov, DSc, in the period 2009-2021. In the second chapter, new results are obtained for local and semi-local convergence of a modified Weierstrass method. In the third chapter, new theorems for local convergence of the Dochev and Burnev method, estimates of the error and the asymptotic constant are obtained. In the fourth chapter, a new family of simultaneous methods of the Dochev and Burnev type with accelerated convergence is constructed and studied. In the conclusion, the PhD student made a self-assessment of the contributions contained in the dissertation and described the approbation of the obtained results.

I support the main contributions described by the PhD student in the current dissertation. Namely:

- The convergence of a modified Weierstrass method is investigated and local and semi-local convergence theorems are obtained that generalize, improve and complement existing results of this kind.
- Local convergence of the Dochev and Burnev method is studied and theorems are obtained that generalize, improve and complement existing results of this kind.
- A new family of simultaneous methods of the Dochev and Burnev type with correction was constructed and local and semi-local convergence theorems were obtained for it.
- Numerical implementations of the studied methods were made, and the obtained theorems for semi-local convergence were applied for computer verification of their convergence.

I do not detect "plagiarism" in the works of the author and the presented thesis in the sense of the Law on the Development of the Academic Staff in the Republic of Bulgaria.

## 6. Assessment of the Dissertation's Publications and Personal Contributions of the Author

The presented dissertation is based on 3 publications in English, of which 2 in journals and 1 in conference proceedings. One of the articles is in a journal with an impact factor of IF=2.713 and Q2, and another is indexed in SCOPUS and has SJR=0.177. They form a total of 90 points, which exceeds exactly three times the minimum national criteria for this indicator, requiring 30 points. All 3 presented articles are co-authored by some of the two scientific supervisors. For me, the candidate's personal contribution to them is undoubted.

The PhD student has also submitted a list of noticed citations of the dissertation publications, which includes 3 titles, two of which are in journals with IF and the third in a journal with SJR. I should note that the presence of citations is not mandatory for the acquisition of the educational and scientific degree "Doctor" (PhD) according to the minimum national requirements.

I have no major criticisms. But I could still point out a few minor ones. In my opinion, the term used "computer proof" is not appropriate. I did not read in the dissertation whether the doctoral student identified any specific perspectives for the development of this research. The presented CV is too concise and not entirely accurate.

**7. Summary**

The Summary, written in Bulgarian and in English, has 32 pages, corresponds to the requirements of RDASPU and contains the main results obtained in the dissertation work.

**8. Recommendations for Future Use of Dissertation Contributions and Results**

I wish the PhD student to continue working in this interesting field and with the same enthusiasm.

**CONCLUSION**

The dissertation ***contains scientific, scientific-applied and applied results, which are an original contribution to the science*** and **meet all the requirements** of the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for the Implementation of the LDASRB and the relevant Regulations of Plovdiv University "Paisii Hilendarski". I detect no plagiarism. The presented materials and dissertation results far exceed the minimum national requirements introduced by the Regulations for the Implementation of the LDASRB.

The dissertation work shows that the PhD student Plamena Ivanova Marcheva possesses in-depth theoretical knowledge and professional skills in the scientific specialty Mathematical Analysis, **demonstrating** qualities and skills for conducting research with obtaining original and significant scientific contributions.

Due to the above, I confidently give my positive assessment of the conducted research, presented by the above-reviewed dissertation work, summary, achieved results and contributions, and ***I propose to the honorable scientific jury to award the educational and scientific degree "Doctor" (PhD)*** to Plamena Ivanova Marcheva in the Area of Higher Education 4. *Natural sciences, Mathematics and Informatics*; Professional Field 4.5. *Mathematics;* Doctoral Program *Mathematical Analysis*.

11.03.2023 Scientific jury member: .....

Plovdiv Prof. Dr. Hristo Stefanov Kiskinov