

STATEMENT

regarding the competition for the academic position “Professor”

Field of higher education: 4. Natural sciences, mathematics and informatics,

Professional field: 4.5 Mathematics (Computational Mathematics)

announced in the State Gazette, No. 48 of 13.06.2025

for the needs of the Technical University – Gabrovo,

Department of Mathematics, Informatics and Natural Sciences

Candidate: Milena Radoslavova Racheva

Prepared by: Prof. Dr. Svetoslav Nenov

1. General description of the materials submitted to the competition

Associate Professor Milena Racheva is employed on a full-time contract in the Department of Mathematics, Informatics and Natural Sciences at the Technical University – Gabrovo. A total of 37 articles have been submitted for review, 4 of which replace a habilitation thesis by means of scientific publications in journals indexed in major international scientific databases such as Web of Science and/or Scopus. Five of the articles are single-author works, 21 have one co-author, and the remaining 11 have two or three co-authors. Overall, 15 of the publications are indexed in Web of Science and/or Scopus, and two more are indexed in Zentralblatt.

In accordance with the requirements of the Technical University – Gabrovo, the candidate has also submitted all her publications that were included in previous procedures — for obtaining the scientific degree “Doctor”, the higher scientific degree “Doctor of Sciences”, and for appointment to the academic position “Associate Professor”. The submitted documents explicitly contain information about the scientific assets with which the candidate successfully completed registration in NACID for “Doctor”, “Doctor of Sciences” and Associate Professor. All of the above allowed me to obtain a complete picture of the candidate’s overall scientific activity and output.

In the competition, Assoc. Prof. Racheva also submitted two textbooks for students at the Bachelor’s and Master’s levels, which actively apply mathematics within technical sciences.

2. Overview and contributions of the scientific results

The publications participating in the competition cover a variety of topics, but mainly concern results related to the theory of the finite element method (FEM). A substantial portion of them (17 items) are published in reputable journals and are indexed in international scientific databases.

My personal opinion on the most significant contributions among the submitted publications is as follows:

- **Development of nonconforming FEM.** Despite some drawbacks, this method has a number of advantages: a simpler structure of the finite algebraic system and applicability for obtaining lower approximations of the real spectrum. Modifications of known finite elements have been obtained ([8.8], [8.11], [8.18]). Original approaches (algorithms) for two-sided spectral estimates are presented ([8.7], [8.9], [8.13], [8.21], [8.24]).
- **New and original application of mixed FEM.** In articles [8.1]–[8.3] a new approach is proposed for linearizing the quadratic Sturm–Liouville eigenvalue problem via a suitable variational transformation. The mixed FEM then allows approximation of problems with quadratic eigenvalues of second and fourth order. This approach proves suitable even for approximating sixth-order problems with lowest-degree elements — see articles [8.4] and [8.14].
- **Other notable contributions:**
 - Approximation of a problem posed on an unbounded domain. In [8.5] conformally connected infinite elements (“infinite large elements”) are proposed for solving eigenvalue problems in unbounded domains;
 - Article [8.6] provides theoretical estimates for the quality of a semi-discrete method for an integro-differential equation modelling a dynamic viscoelasticity problem;
 - Significant acceleration of convergence for fourth-order problems was achieved. Substantial difficulties in the use of patch-recovery techniques with macroelements have been overcome.

Finally, I note that several papers address and model engineering processes; the range of topics corresponds to the profile of the university that announced the present competition.

3. Impact of the scientific publications

The submitted publications have accrued 96 citations that were not included in previous procedures; these citations appear in reputable journals, predominantly with high impact factors.

4. Teaching and pedagogical activity

Milena Racheva has an impressive teaching career. She has worked for approximately 33 years at the Technical University – Gabrovo and its branch in Lovech. She has taught lectures, seminars and laboratory exercises in all mathematical courses offered at TU – Gabrovo.

Assoc. Prof. Racheva developed and successfully introduced two new courses into the curricula: “Applied Mathematics” for the Bachelor’s degree and “Contemporary Mathematical Methods for Electrical Engineers” for the Master’s degree. These courses

undeniably strengthen the role of mathematics among future engineers and contribute to their education.

For the competition, Milena Racheva has submitted two textbooks: *Applied Mathematics* (single author) and *Numerical Methods in Electrical Engineering* (co-authored). The textbooks are professionally written and correspond to the aforementioned courses.

She has supervised one successfully defended doctoral student.

5. Critical remarks and recommendations

I have no substantial critical remarks regarding Assoc. Prof. Racheva's scientific and teaching activities. Upon further review I found that the publications submitted to the competition that are indirectly related to computational mathematics are the result of long-term collaborative work of Assoc. Prof. Racheva with colleagues — engineers and economists — in the fields of energy and energy and economic efficiency.

I would recommend that, after consolidating her results from previous procedures, Assoc. Prof. Racheva prepare a monograph on nonconforming FEM.

6. Personal impressions

I have both direct and indirect impressions of Milena Racheva as an honest and correct colleague. She was a doctoral student at IICT — Bulgarian Academy of Sciences, Sofia, and in 2014 she defended a doctoral dissertation at the same institute for obtaining the higher scientific degree “Doctor of Sciences”. It is important to note that she spent an academic year at Chalmers University, Gothenburg, Sweden, where she had the opportunity to interact with leading international researchers in computational mathematics.

I am also aware that since 2022 she has been successfully serving as Editor-in-Chief of the international journal *Mathematical Modeling*, published by the Scientific and Technical Union for Machine Building in Bulgaria.

7. Conclusion

I state that the materials submitted in the competition fully satisfy the requirements of ZRAS RB, the implementing regulations of ZRAS RB, and the Rules for acquiring scientific degrees and occupying academic positions at the Technical University – Gabrovo.

In view of the above, I propose that Assoc. Prof. DSc Milena Radoslavova Racheva be elected to the academic position of Professor at the Faculty of Economics and Management, Department of Mathematics, Informatics and Natural Sciences (MINS) of the Technical University – Gabrovo in the field of higher education 4. Natural sciences, mathematics and informatics; professional field 4.5 Mathematics, specialty “Computational Mathematics”.

20.10.2025
Sofia

Signature:
/Prof. Dr. Svetoslav Nenov/