REVIEW

for the competition to fill the academic position of "Associate Professor" in professional field 5.1 "Mechanical Engineering," scientific specialty "Mechanical Engineering Technology," for the needs of the Technical University of Gabrovo, announced in the State Gazette, Issue No. 53 / June 9, 2026

Candidate: Senior Assistant Professor Dr. Kalin Vladimirov Anastasov

Reviewer: Prof. Nikolay Dimitrov Minchev, D.Tech., DHC

1. General Information and Biographical Data

The sole candidate in the competition, Senior Assistant Professor Dr. Kalin Vladimirov Anastasov, was born on May 22, 1978. He graduated from the Technical University of Gabrovo in 2008 with a degree in "Mechanical Engineering and Technologies." In 2016, he defended his doctoral dissertation on the topic "Investigation of the Performance of Cutting Tools Created Using the Injection Molding Method." Since 2020, he has been an assistant professor in the Department of Mechanical Engineering and Technology at the Technical University of Gabrovo, and since 2024, he has been a senior assistant professor.

Senior Assistant Professor Dr. Kalin Anastasov teaches the following courses:

– Design of Tooling for Injection Molding;

– Molding Equipment and Machinery;

– Specialized (non-standard) machining methods and tools;

– Unconventional technologies in mechanical engineering;

– Technologies and equipment for processing non-metallic materials;

– Powder metallurgy;

– Electrophysical and electrochemical machining methods;

– Unconventional methods for machining materials.

In addition, he leads laboratory exercises and a course project on "Metal-Cutting Tools."

2. General Description of the Presented Materials

Senior Assistant Professor Dr. Kalin Anastasov is participating in the competition for the position of associate professor with works that fall into the following groups:

– **Criterion A –** doctoral dissertation and 7 related publications;

– **Criterion B4 –** habilitation thesis – 14 publications that are cited and indexed in world-renowned scientific databases;

– **Criterion G7 –** 1 publication in journals that are peer-reviewed and indexed in world-renowned scientific databases;

– **Indicator G8 –** 13 scientific publications in non-refereed peer-reviewed journals;

– **Indicator D12 –** evidence of 43 citations in scientific publications that are peer-reviewed and indexed in world-renowned databases;

– **Indicator D14 –** evidence of 12 citations in publications in non-refereed peer-reviewed journals;

– **Indicator E23 –** one textbook;

– **Indicator E24 –** one course assignment guide.

All works are accepted for review, with the exception of publications related to the dissertation.

The following criteria for meeting the minimum national scientometric requirements have been met:

Indicator Group	**Indicator**	**Minimum number of points**	**Candidate's points (by indicator)**	**Candidate's score (total for the group)**
A	Criterion 1	50	50	
B	Indicator 4	100	199.5	
G	Indicator 7	200	8	214.6
	Indicator 8		206.6	
D	Indicator 12	50	430	454
	Indicator 14		24	
E	Indicator 23	–	40	60
	Indicator 24		20	
Total points		**400 (430*)**	**978.1**	

The RILDASRB defines a minimum required total of 400 points across indicators A, B, C, and D. There are no requirements for the position of associate professor regarding the other indicators. In this case, Senior Assistant Professor Dr. Kalin Anastasov has achieved a score of 918.1 points. In addition, he has met the requirement for Indicator E—60 points. This results in a total score of 978.1 points.

3. Major Scientific and Applied Scientific Contributions

3.1. Contributions in the Habilitation Thesis (Criterion "B")

3.1.1. Applied scientific contributions

1. Conceptual justification and theoretical modeling of new processes for PPD

- The Slide Roller Burnishing (SRB) method was developed and theoretically justified, [V.4.1.].
- An original mathematical model has been developed to predict the amount of deformation-induced α' martensite during Diamond Burnishing (DB), [V.4.9.].

- A cost-effective approach for optimizing DB based on the interrelationships between “process – surface integrity (SI) – operational behavior” has been justified, [B.4.4., B.4.10.].

2. Design and optimization of environmentally sustainable, combined, and hybrid technologies

- Sustainable “green” and hybrid DB processes for machining 42CrMo4 structural steel and CuZn39Pb3 lead brass have been developed and investigated, [B.4.3., B.4.5., B.4.7., B.4.13.].
- An integrated technology for additively manufactured components has been developed, [B.4.11.].
- Specialized PPD processes have been developed for finish PPD with sliding friction using Ferro-Tic Grade C elements and a toroidal roller, [B.4.12.], [B.4.8., B.4.12., B.4.13.].

3. Microstructure Modification and Control of Surface Microhardness

- It has been demonstrated that the developed sustainable DB processes form a modified surface layer, [B.4.2., B.4.3.].
- A multi-hardening effect has been achieved in additively manufactured steels, [B.4.11.].
- A change in surface microhardness with depth has been observed, [B.4.2., B.4.10.].

4. Optimization of Geometric Characteristics and Stress State (Surface Integrity)

- It has been demonstrated that the SRB method reduces surface roughness by up to a factor of 2 compared to conventional roll forming, [B.4.1., B.4.3., B.4.7., B.4.8., B.4.11.].
- Deep compressive residual stresses exceeding 0.5 mm have been induced, [B.4.1., B.4.3., B.4.11., B.4.12.].
- Technological compensation for tool wear has been achieved, [B.4.6., B.4.10.].

5. Improvement of the tribological properties and fatigue life of the components

- Tribological behavior has been optimized, [B.4.1., B.4.13.].
- Strength and fatigue life have been radically improved, [B.4.5., B.4.12., B.4.14.].
- A synergistic effect has been achieved in terms of controlled wear, [B.4.10.].
- The operational reliability of axles and shafts has been improved, [B.4.13.].

3.1.2. Applied Contributions

1. Optimization of process parameters in roller bearing machining (RB and SRB)

- The invariance and stability of the SRB method have been demonstrated, [B.4.1.].
- A functional optimization of the surface SI properties obtained via SRB has been performed, [B.4.2.].
- Operating conditions for a stable RB process have been determined, [B.4.14.].

2. Environmental Sustainability and Optimization of DB

- Environmentally friendly DB processes have been validated, [B.4.3.].

3. Patterns of rough machining and control of factors in turning

- Optimal pre-turning conditions for achieving minimum average surface roughness have been defined, [B.4.5.].
- The dominant factor in the turning of lead brass has been identified, [B.4.7.].
- Conditions for rough turning with cutting elements made of cermet alloy have been determined, [B.4.9.].

4. Effect of cutting tool wear and its technological compensation via DB

- The service life of the cutting insert until complete wear has been quantitatively determined, and time limits for the stability of the DB have been established, [B.4.6.].
- The technological compensation of defects has been investigated, [B.4.10.].

5. Integrated Technologies for Additive Manufacturing (LPBF) and Hybrid Finishing

- Hybrid combined manufacturing processes for structural steels have been investigated, [B.4.13.].

3.2. Contributions from the publications of Groups G7 and G8 (Indicator “G”)

3.2.1. Scientific and Applied Contributions

1. Investigation, optimization, and modification of materials and surfaces (laser and thermal technologies):

- The phase state, characteristic zones, and mechanical properties were determined for a combined treatment method (laser cladding followed by nitriding) of tool steel 1.2343, [G.7.1.].
- The effect of sintering conditions in a nitrogen atmosphere on the intergranular corrosion resistance of 316L steel parts produced by Metal Injection Molding (MIM) was also determined, [G.8.7.].
- **Laser modification and** surface **roughness:** The effect of surface laser modification on the microstructure, microhardness, and surface roughness of high-speed steel 1.3343 in a heat-treated condition was determined, [G.8.8.].

2. Theoretical and experimental modeling and analysis of cutting and deformation processes:

- **Comprehensive roughness models:** Comprehensive theoretical and experimental models for the formation of surface roughness during turning have been developed; these models reflect the influence of cutting conditions during the turning of improved 42CrMo4 steel [G.8.1.] and lead brass CuZn39Pb3 [G.8.6.].
- **Influence of operational and geometric factors:** The effect of cutting insert wear on the 2-D roughness parameter Ra during the turning of improved 45 steel was

investigated and analyzed [G.8.3.]. The influence of tool geometry (from Ferro-Tic "C") and the deforming force during surface plastic deformation (SPD) of brass was also determined [G.8.5., G.8.12.].

3. Stability and Monitoring of Casting Processes:

- **Dimensional stability in casting:** The stability of the high-pressure die-casting process for aluminum alloys was evaluated based on the “dimensional stability” criterion for castings with threaded surfaces [G.8.4.].
- **Long-term defect monitoring:** Long-term monitoring and analysis of defect occurrence in components (MoldMax HH beryllium bronze pistons) on casting machines were conducted, and their impact on the overall process stability was defined [G.8.9.].

3.2.2. Applied Contributions

1. Implementation of restoration and regeneration technologies:

- **Matrix technology:** A comprehensive technology for the restoration of worn working surfaces on forming elements made of 1.2343 steel has been developed and implemented [G.7.1., G.8.10.].

2. Systematization and technological quality assurance:

- **Ensuring Surface Texture:** The technological capabilities and stability of a turning-milling center have been systematized, [G.8.11.].

3. Design for additive manufacturing:

- **3D printing of industrial components:** A manufacturing process for additive manufacturing (3D printing) of a specific industrial part made of tooling material has been designed [G.8.13.].

4. Significance of the Contributions to Science and Practice

From a scientific perspective, these contributions transform empirical knowledge into rigorous mathematical and physical models. Through the innovative SRB method and the new friction/deformation models (for 42CrMo4 steel and CuZn39Pb3 brass), the mechanisms governing the formation of surface relief have been revealed. The introduction of the Surface Integrity paradigm through the “process–SI–operational behavior” triad shifts the focus toward targeted management of fatigue life. The scientific value is complemented by the non-destructive quantitative prediction of phase transitions (α’ martensite), the elucidation of the mechanisms for generating deep compressive residual stresses, the investigation of laser-thermomechanical effects, and the definition of stability criteria for stochastic processes in casting.

From a practical standpoint, the research offers high-tech solutions ready for implementation. The developed modes for preliminary turning, RB, and SRB ensure minimal surface roughness and defect-free production, while automated compensation for tool wear via DB eliminates the subjective factor. These contributions pave the way for the

industrial adoption of additive and hybrid technologies through methodologies for the machining and design of 3D-printed parts (LPBF) with a guaranteed service life for critical components (shafts, axles).

The environmental and economic impact is reflected in the validation of “green” processes without lubricating-cooling fluids in accordance with ISO standards and the implementation of circular economy principles through a comprehensive technology for the regeneration of expensive 1.2343 steel forming elements.

The significance of these contributions is clearly demonstrated by the result for indicator D12. Credit for this is also due to Prof. Y. Maximov, who established a research team whose scientific results are internationally recognized.

5. Conclusion

According to the Law on Academic Ranks and Positions in the Republic of Bulgaria (RILDASRB), candidates for the position of “associate professor” must meet the conditions defined in Article 24. In this case, Senior Assistant Professor Dr. Kalin Anastasov satisfies this condition.

Pursuant to Article 1a, paragraph 1 of the Regulations for the Implementation of the Law on Academic Ranks and Positions in the Republic of Bulgaria (RILDASRB), candidates for the academic position of “associate professor” must meet the relevant minimum national requirements and the requirements of the higher education institution as set forth in Article 1a, paragraph 2 of the RILDASRB.

The requirements under Article 1a, paragraph 1, and its Annex specify a minimum score of 400 for associate professor competitions. In this competition, the candidate has earned 978.1 points. It is evident that the scientometric requirements have been significantly exceeded.

The additional requirements of the Technical University of Gabrovo under Article 1a, paragraph 2, have also been met.

The introduction of scientometric indicators formalizes the evaluation of scientific output, which should eliminate the subjective factor.

Therefore, based on the clear scientometric indicators and the significance of the scientific and applied contributions, I strongly recommend that the esteemed Scientific Jury propose that Senior Assistant Professor Dr. Eng. Kalin Vladimirov Anastasov be appointed to the academic position of “Associate Professor” in professional field 5.1 “Mechanical Engineering,” in the scientific specialty “Mechanical Engineering Technology” for the needs of the Technical University of Gabrovo.

Date: .....

Reviewer: .....
(Prof. Nikolay Minchev, D.Tech., DHC)