

STATEMENT REPORT

by Prof. Ivo Mihaylov, D. Sc.

University of Plovdiv “Paisii Hilendarski”

on the PhD dissertation of **Marin Vladimirov Genov**

entitled: *“Functions Holomorphic over Finite-Dimensional Commutative Associative Unital $\mathbb{C}$ -Algebras – Some Local, Global, and Universal Aspects”*

for obtaining the educational and scientific degree “Doctor of Philosophy” (PhD)
in the field of higher education 4. *Natural Sciences, Mathematics, and Informatics*,
Professional field 4.5 *Mathematics*,
Doctoral Programme *Geometry and Topology*

By order № 83/14.08.2026 of the Director of the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences (IMI–BAS), I have been appointed as a member of the Scientific Jury for the procedure for the defense of the PhD dissertation entitled *“Functions Holomorphic over Finite-Dimensional Commutative Associative Unital $\mathbb{C}$ -Algebras – Some Local, Global, and Universal Aspects”*, for obtaining the educational and scientific degree “Doctor of Philosophy” (PhD) in the field of higher education 4. *Natural Sciences, Mathematics, and Informatics*, Professional field 4.5 *Mathematics*, Doctoral Programme *Geometry and Topology*. The author of the dissertation is Marin Vladimirov Genov, a part-time PhD student at the Section of Analysis, Geometry and Topology of IMI–BAS, with scientific supervisor Prof. Ludmil Katzarkov, replaced later by Acad. D.Sc. Vesselin Drensky.

This report has been prepared in accordance with the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria (ADASRB), The Rules for Implementation of the ADASRB, the Rules on the Terms and Requirements for Acquisition of Scientific Degrees and Occupation of Academic Positions of BAS and the corresponding Rules of IMI-BAS.

1 GENERAL DESCRIPTION OF THE DISSERTATION

The present dissertation, authored by Marin Vladimirov Genov, is dedicated to the development and systematic foundation of function theories over finite-dimensional commutative associative unital algebras over $\mathbb{K} \in \{\mathbb{R}, \mathbb{C}\}$. The overarching objective of the thesis is to generalize classical single-variable complex analysis and n -variable complex geometry to functions taking values in a finitely generated module over a finite-dimensional algebra $\mathcal{A}$ having an $\mathcal{A}$ -linear differential.

The dissertation comprises an Introduction & Overview (pp. 1–93), preliminary sections on algebraic, topological, and norm-theoretic tools (Chapter 0), two main research chapters (Chapter 1 (pp. 94–154) and Chapter 2 (pp. 155–188)), an appendix on structure tensors, and a rich, comprehensive bibliography. The thesis spans 227 pages.

The foundational design of the work carefully separates algebraic effects (valid over real/complex scalar fields without requiring a full complex structure) from topological and spectral phenomena (which fundamentally rely on the topology of the unit group $\mathbb{C}^\times$ and spectral reductions to $\mathbb{C}^n$). This distinction allows the author to achieve both maximal generality and stronger formulations of classical results (such as Cauchy-Goursat, Cauchy's Integral Formula, automatic analytic extensions, and Cauchy-Pompeiu representations) than those previously known in the existing literature.

2 ASSESSMENT OF THE DISSERTATION ABSTRACT

The dissertation abstract (autoreferat) has been prepared in accordance with the established statutory requirements. It provides an accurate, clear, and faithful summary of the content, structure, and main mathematical results presented in the dissertation. The abstract correctly reflects the overall framework of the work, highlighting the main theorems, preliminary definitions, and conclusions.

3 CONTRIBUTIONS OF THE DISSERTATION

3.1 Style of Presentation and Lack of Expository Context

Chapters 1 and 2 are structured almost entirely as a dense, uninterrupted sequence of formal definitions, propositions, theorems, proofs and remarks. The text completely lacks descriptive prose, conceptual motivation, and transitional commentary. The remarks concern details in the proofs but fail to clarify the overall logic behind the sequence of mathematical statements, the geometric or intuitive meaning of the conditions, or why specific technical generalizations are introduced.

A doctoral dissertation is expected to be an expository, self-contained monograph rather than a dry collection of formal results. Reducing the core technical chapters to a list of statements reflects either a serious flaw in academic writing standards or an attempt to blur the boundary between established literature and the candidate's original contributions.

3.2 Total Absence of Citations and Attribution

A critical defect of the manuscript is the complete omission of explicit citations within Chapters 1 and 2. Classical results from commutative algebra, differential calculus over algebras, and function theory are presented side-by-side with original claims without any distinction or attribution. Known theorems and standard preliminary lemmas are not credited to their original authors or foundational references. Original claims are not explicitly labeled as new theorems developed by the candidate. This lack of transparency places an undue burden on the reviewer to manually cross-reference the text with existing

literature to determine what belongs to the candidate and what has been transcribed from external sources.

3.3 Assessment of Novel Content in Chapters 1 and 2

Despite the severe presentation issues, a comparative evaluation against the existing literature (and the candidate’s two published papers) shows that Chapters 1 and 2 are not entirely devoid of original content. However, the novel elements are highly isolated:

- **Standard/Classical Content (Bulk of Chapters 1 & 2):** The vast majority of the propositions represent standard structural linear algebra, known properties of differential forms ($\omega = dZ \cdot f(Z)$), and direct adaptations of classical single-variable Cauchy theory via algebraic decomposition (e.g., using idempotents).
- **Potentially Novel Elements:**
 1. *Generalized Wirtinger Operators (Section 1.3):* The formulation of universal Wirtinger-type operators expressed directly in terms of the algebra A (rather than depending explicitly on the representation module M) represents a neat structural observation.
 2. *Spectral Integration and Homotopical Reduction (Section 2.1 & 2.2):* The use of the spectrum (characters χ_j) to reduce Cauchy-type integrals over A to Cartesian products of the complex plane $\mathbb{C}$ provides a genuinely stronger, spectrally-homologous formulation of Cauchy’s Integral Formula compared to older literature (e.g., Rizza’s work).
 3. *Relaxed Regularity for Cauchy–Goursat (Section 1.4):* The adaptation of Pringsheim’s proof to remove continuous derivative assumptions for algebra-valued functions.

3.4 Conclusion

While Chapters 1 and 2 do contain a few technically sound and novel mathematical refinements, their presentation is deeply problematic. The complete absence of attribution and the choice to write the main body as a list of statements makes it impossible to view the dissertation as a well-crafted monograph. The novel results, while valid, are incremental technical extensions rather than major conceptual breakthroughs.

4 PUBLICATIONS AND OTHER ACTIVITIES RELATED TO THE DISSERTATION TOPIC

The candidate’s original scientific contributions are documented in two peer-reviewed publications directly corresponding to the core results presented in the dissertation:

1. **M. Genov**, "Holomorphy over finite-dimensional commutative associative $\mathbb{C}$ -algebras: local theory", *Comptes rendus de l'Académie bulgare des Sciences*, Vol. 77, No. 5 (2024), pp. 646–656, DOI: 10.7546/CRABS.2024.05.02. This journal is indexed in Scopus (**Q3/Q4** rank).
2. **M. Genov**, "The Generalized Homological Cauchy Integral Formula for A -Holomorphic Functions", to appear in *Serdica Mathematical Journal* (accepted for publication, 2026). This journal is indexed in Scopus (**Q4** rank).

These two publications fulfill the minimal national quantitative requirements for the award of the educational and scientific degree "Doctor" under the Development of Academic Staff in the Republic of Bulgaria Act (ZRASRB). However, as highlighted in the critical remarks, these articles contain the candidate's entire novel mathematical output (totaling roughly 15 pages), which has been significantly inflated to form the 227-page dissertation manuscript.

5 OTHER CRITICAL NOTES

A rigorous examination of the introductory motivation (p. 4) and the overview of new results (pp. 8–11) reveals serious structural and pedagogical shortcomings that further undermine the academic value of the dissertation.

5.1 Methodological Analysis of Motivation & Goals of the Present Thesis (page 4)

An analysis of AI detectors of the provided text on page 4 reveals an **exceptionally high probability of having been written or heavily edited using AI** (such as ChatGPT or Claude).

Although it incorporates domain-specific mathematical terms, its stylistic and phrasing patterns carry classic "AI footprints" typical of modern large language models: idiomatic AI clichés and metaphors, syntactic parallelism and structure, overly declarative and grandiose tone, etc.

5.1.1 Conclusion

The passage was almost certainly **generated directly by AI** via a prompt asking to articulate the goals and motivation for a dissertation on commutative associative algebra theory, emphasizing how the text modernizes outdated literature. More importantly, this reliance on artificial rhetoric conceals the candidate's own voice. Instead of offering a genuine, self-authored rationale for the work, the text avoids clearly formulating the specific open problems being tackled or articulating the actual mathematical necessity of the research. Using such generic text-generation in a doctoral thesis raises valid concerns about

whether the author can independently define the precise scope, context, and limitations of his personal contributions.

5.2 Methodological Analysis of Overview of the Present Thesis & New Results (pp. 8–11)

The overview of new results provided on pages 8–11 attempts to outline the main outcomes of Chapters 1 and 2, but it ultimately remains too vague and abstract to be truly useful. Rather than giving a precise, mathematically rigorous account of the specific theorems and their proofs, these pages merely sketch broad intentions.

More importantly, this section attempts to replace the narrative that belongs in the main body of the dissertation. Conceptual motivation, geometric intuition, and historical context should naturally introduce the formal statements directly within Chapters 1 and 2. By isolating all explanations on pages 8–11 and reducing the core chapters to sequences of definitions and theorems, the author leaves the structure of the thesis feeling disconnected and hard to follow. As a result, the reader is left without local context or guidance when navigating the technical material in the main text.

6 FINAL CONCLUSION AND RECOMMENDATION

The dissertation of Marin Vladimirov Genov contains original mathematical results, and the quantitative metrics required by the Act on Development of the Academic Staff in the Republic of Bulgaria (ADASRB) are formally satisfied through two peer-reviewed publications.

However, the qualitative presentation suffers from serious defects. Chapters 1 and 2 lack explicit attribution and local narrative prose, while the novel output is heavily expanded into a 227-page formal enumeration. Furthermore, key introductory passages rely on AI-generated rhetoric, which conceals the author’s independent mathematical voice.

Considering that the candidate meets the minimal requirements and possesses valid scientific contributions, my positive vote is **conditional upon the defense**, during which the candidate is expected to explicitly address these critical methodological remarks in his presentation and provide satisfactory explanations to the jury.

Subject to a convincing response at the public defense, I recommend that the Scientific Jury award the educational and scientific degree **”Doctor of Philosophy” (PhD)** to **Marin Vladimirov Genov** in Professional Field *4.5 Mathematics (Geometry and Topology)*.

Date: 15.09.2026

Signature: _____
([Ivo Mihaylov, Prof. D.Sc.]