

# R E P O R T

on the competition with a single applicant

**Assoc. Prof. Maya Miteva Stoyanova**

Scientific field: **4. Natural sciences, mathematics and informatics**

Professional field: **4.5. Mathematics (Algebra, coding theory and applications)**

Announced in “Durzhaven vestnik” no. 63/30.07.2021.

The competition for the position of a full professor is announced in “Durzhaven vestnik” no. 63/30.07.2021. There is one application for the position by:

**Assoc. Prof. Maya Miteva Stoyanova.**

I am going to evaluate the scientific and teaching activities of the candidate as described in the documents presented for this competition. The scientific research of the applicant corresponds thematically to the description of the position.

## 1. Personal Data

Maya Stoyanova is born on the 28th of February 1969 in Botevgrad. In 1992 she graduates from the Faculty of Mathematics and Informatics of Sofia University “St. Kliment Ohridski” with a specialization in geometry. In 2006 she obtained a PhD degree from the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences with a thesis “On the structure of some spherical codes and designs” with scientific advisor Prof. Peter Boyvalenkov.

In the period 1992–1999 she was working as a part-time assistant in department Geometry and in the period from 1999–2014 she was assistant in department Algebra of the Faculty of Mathematics and Informatics. In 2014 Maya Stoyanova obtained the position of the associate professor in department Algebra in the Faculty of Mathematics and Informatics of Sofia University, where she is employed up to the present moment.

## 2. Research Activity

The candidate presents 13 scientific papers in the area of algebraic combinatorics. The scientific investigations of the candidate lie in the field of spherical codes and designs and in the theory of the orthogonal arrays. These areas of scientific research correspond fully to the subject of the competition.

Eight of the papers are published in prestigious scientific journals; six of them have an impact factor; two papers have an SJR. Five papers are published in the proceedings of international conferences and symposia. The papers are published in the following journals:

- IEEE Transactions on Information Theory (IF)
- Problems of Information Transmission (IF)
- Designs Codes and Cryptography (IF)
- Discrete Applied Mathematics (IF)
- Analysis and Mathematical Physics (IF)
- Comptes Rendus de l'Academie bulgare des Sciences (IF)
- Electronic Notes in Discrete Mathematics (SJR)
- Annual of Sofia University
- Proceedings of REDUNDANCY
- Proceedings of the IEEE Symposium on Information Theory (ISIT) (SJR)
- Proceedings of the Workshop on Optimal Codes 2013 (2)
- Proceedings of the International Workshop on ACCCT

In one of the above papers the candidate has one co-author; in six she has two co-authors; in one – three co-authors; and in five – four co-authors. All the papers are published after the habilitation and have not been used in previous procedures. The candidate presents statements from the other co-authors who declare that the contribution of the candidate in the joint papers is equally weighted. In my view, there is no doubt that the contribution of the candidate in the joint papers is significant and at least equal to that of the other authors.

The author classifies the presented papers in the following two subjects:

(A) Codes in Hamming spaces.

In this group of papers, the candidate tackles the problem of improving the existing classical bounds for the cardinality of codes and designs with special properties. The main method used here is that of linear programming which leads to bounds of the Levenshtein type. Furthermore, the potential energy of codes is investigated for various potentials  $h$ . The candidate obtains universal bounds for the potential energy of codes and designs in Hamming spaces.

(B) Orthogonal arrays

In these papers, the candidate investigates the existence problem for orthogonal arrays with prescribed parameters. The approach is to investigate the spectrum of

an orthogonal array by finding all possible spectra for the admissible substructures. The goal is to reject all possible spectra which proves the nonexistence of the orthogonal array in question.

### 3. Main results

In my opinion the most important scientific results of the candidate are the following:

- (1) Bounds of Levenshtein type for the cardinality of spherical codes of given minimal and maximal distance are proved.
- (2) Universal bounds for the potential energy of codes of given maximal distance and fixed cardinality.
- (3) Universal bounds for the potential energy of codes and designs in Hamming spaces are proved that can be considered as generalization of the Levenshtein bounds.
- (4) Generalizations and  $q$ -analogs of the MacEliece bounds are proved.
- (5) The nonexistence of binary orthogonal arrays for the following parameters is proved:

$$(9, 112, 4), (10, 224, 5), (9, 96, 4), (9, 192, 5), (10, 112, 4), (11, 224, 5), \\ (11, 112, 4), 12, 224, 5).$$

- (6) Analytic upper bounds for the cardinality of orthogonal arrays are proved. In particular, the nonexistence of orthogonal arrays with parameters  $(n, n + 4, 6 \cdot 2^{n+4})$  is proved, for every  $n \geq 8$ .

### 4. Teaching Activities

The teaching activities of Assoc. Prof. Maya Stoyanova include various obligatory courses for undergraduate students like “Linear Algebra” and “Algebra” for the programs Software engineering and Mathematics and Informatics, as well as optional courses like “Spherical codes and designs. Orthogonal arrays”, “Codes in polynomial metric spaces” I and II, “Selected chapters from abstract algebra” I and II.

Assoc. Prof. Maya Stoyanova is the scientific advisor of two PhD students who successfully defended their PhD Theses: tanya Marinova and Tedis Arben Ramaj.

### 5. Projects, Conferences etc.

After 2000 the candidate has taken part in seven national scientific projects among which the more important are project KP-06-N32/2-2019 “Algebraic and geometric methods for data protection” with coordinator Prof. Peter Boyvalenkov, project DN02/2, 13.12.2016 “Codes and combinatorial configurations” with coordinator Prof. Iliya Bouyukliev, project MM-1405/2004 “Algebraic and combinatorial methods in coding theory and informatics” with coordinator Prof. Stefan Dodunekov.

Maya Stoyanova has been the coordinator of two projects supported by the Scientific Research Fund of Sofia University.

The candidate has given more than 50 talks in various international scientific conferences and workshops. She has served as a vice dean for the past four years, as well as a head of department Algebra.

## 6. Numerical Data

According to the application documents the scientific papers of Assoc. Prof. Maya Stoyanova can be classified as follows:

- scientific journals with impact factor: 6
- scientific journals with SJR: 1
- scientific journals without impact factor or SJR: 1
- proceedings with conference talks having SJR : 1
- proceedings with conference talks without SJR : 4

The total impact factor of the presented papers is over 6 which can be considered as an evidence for the high quality of the scientific production of the candidate. In her application the candidate presents 13 citations of her scientific papers, which cover the minimal national requirements. One of her publications is cited in the latest edition of the classical book by Bannai, Bannai, Ito and Tanaka Algebraic Combinatorics. For me, this is a compelling evidence that the scientific work of the candidate is significant and well-accepted within the professional community.

The total number of publications of Maya Stoyanova is 46, among them 24 are in scientific journals and 22 are in the proceedings of scientific conferences. The total number of citations 64, while the h-index according to Scopus is 5. The results of the candidate are presented more than 50 times at scientific conferences.

I accept the self-assessment presented by the candidate. It becomes clear that she not just fulfills, but exceeds by a wide margin all the national requirements, as well as the specific requirements of the Faculty of Mathematics and Informatics of Sofia University for the position of full professor.

## 7. Critical Remarks.

I have no notable critical remarks.

## 8. Personal Remarks.

I have known the candidate personally for about twenty years. I have attended many of her talks at international and national conferences which are always well-prepared and at a high professional level. My impression is that she is a serious researcher with deep knowledge in the field of algebra who enjoys a solid reputation at home and abroad.

It is beyond any doubt that she has all the merits of a full professor in the Faculty of Mathematics and Informatics.

#### 9. General Assessment of the Applicant

In my opinion, Assoc. Prof. Maya Stoyanova has obtained important scientific results that are original and match the level of contemporary mathematics. Her teaching and project activities, as well as her administrative engagement are equally impressive. Based on this, I assess **positively** the application of Maya Miteva Stoyanova for the position of a full professor in the Faculty of Mathematics and Informatics of Sofia University in the professional field 4.5. Mathematics (Algebra, coding theory and applications).

#### Conclusion

I am deeply convinced that **Assoc. Prof. Maya Miteva Stoyanova** has all the merits and professional qualifications required for the position of a full professor of the Faculty of Mathematics and Informatics of Sofia University for the scientific field 4. Natural sciences, mathematics and informatics, professional field 4.5. Mathematics (Algebra, coding theory and applications). She fulfills all the legal national requirements plus the specific ones of FMI of SU for the professional field 4.5 Mathematics. I strongly recommend her application for the position of a full professor in the Faculty of Mathematics and Informatics of Sofia University "St. Kl. Ohridski".

Sofia, 11.11.2021

Member of the Scientific Panel:

(Prof. DSc Ivan Landjev)