

## PREFACE

This book contains selected papers from the lectures held at the seminar *Mathematics and Music*, founded by Vesna Todorčević and Filip Jevtić in 2018 and hosted on a regular basis by the Mathematical Institute of the Serbian Academy of Sciences and Arts in Belgrade. The lectures aim to present numerous, sometimes not so obvious connections between mathematics and music that have existed from the very beginnings of both disciplines, as well as the relations of mathematics with other forms of art and philosophical thought. In recent years, this interdisciplinary approach has become the focus of larger and deeper research interests worldwide.

The papers reflect the main goal of the Seminar, which is to study the mathematical aspects of music theory, with special attention on the notion of harmony (for example, Neo-Riemannian theory of harmony), melody (for example, application of graph theory to the recognition of similar melodies), rhythm and algorithmic composing, and alike.

Based on connections between mathematics, music, and computer science, the Seminar is also devoted to the popularization of mathematics. Moreover, through a series of lectures by writers and visual artists, it examines various links between mathematics and other arts, thus considerably expanding the audience and the methodological frameworks applied. This thematic and methodological diversity, especially with regard to its diachronic approach, is clearly reflected in the selected papers.

The authors represented in the volume, as well as the other participants of the Seminar, come from a very wide array of academic and artistic fields: they are mathematicians, musicologists and musicians, composers, computer scientists, philosophers and theologians, classicists and historians of art, visual artists and writers – from students to professionals. Among the participants was even a vicar bishop of the Serbian Orthodox Church. The sheer number of lecturers – 90 as of June 2024 – and their professional diversity testify to the intensity and ambitious academic goals of the Seminar. Understandably, not all of them could be included in this volume. A careful selection was made based on which ten participants were invited to contribute papers. A wide range of topics and approaches offered to the readers faithfully reflects the interdisciplinary scope of the Seminar.

In his paper *Pythagorean Music Theory*, **Zoran Lučić** examines this ancient theory as a necessary basis for understanding the definitions of some arithmetical notions in mathematics. *Zvonimir Šikić* presents a paper titled *The Twelve Magnificents*, in which he surveys the history of the theory and practice of musical scales, which culminated in the present-day universal 12-tone scale, and proves that this 12-part division of the octave is optimal. **Saša Popović**'s essay *De Institutione Musica: Boethius' Ancient Sources and Reception History* contains an exposition of Boethius' treatise *De institutione musica*, which is unanimously considered one of the cornerstones of Western musical theory, focusing on Boethius' ancient sources for this work. In his paper *De Harmonia Mundi: The Early Greek Notions of Harmony and Symmetry*, **Noel Putnik** offers a historical-philological examination of the terms *harmonía* and *symmetría* in ancient Greek thought, pointing to a more

comprehensive understanding of their multi-layered meanings in different fields, from mathematics to the arts.

The **Bon brothers, Edi and Ivan** – an astrophysicist and a sculptor and faculty teacher, respectively – present a joint interdisciplinary effort, an essay titled *Relics of the First Sound Waves in the Cosmos through Sound Sculptures*. In their combined artistic-scientific work they present sound sculptures inspired by horn telescopes previously utilized to explore the early universe. These sculptures function as miniature radio-telescopes, enabling the audience to audibly experience the cosmic microwave background radiation (CMBR). In his paper *Liszt's Sonata in B minor and Transcendence*, **Stefan Ivković** searches for the hidden philosophical meaning of Franz Liszt's Sonata by discovering new connections between this work and Goethe's *Faust*, as well as several other well-known literary works. **Karol Beffa** presents an essay titled *Allusions and Illusions. György Ligeti, Drawing, Mathematics, and Music*, which explores the Hungarian composer György Ligeti's links with mathematics, especially as Ligeti initially wanted to pursue a career in science.

In his paper *Spectrum Projections in Musical-Mathematical Analysis*, **Dragan Latinčić** describes the method of rhythmic projections of the harmony spectrum, as well as the application of one of the most important isometric transformations to the projected metro-rhythmic entities of individual harmonics of the spectrum. **Fani Kosona** presents an essay titled *Mathematical Modeling in Music Composition: Strategies, Insights, and Perspectives*, in which she analyses the concept of structural space for music composition, transformed into a multi-dimensional space of musical parameters. Four case studies of music compositions are featured in order to shed some light into the practical aspects of Kosona's approach. Finally, **Filip Jevtić** offers the paper *Smooth Numbers in Music and Architecture* in which he gives a brief history of smooth numbers and their appearances in both music and architecture.

We hope readers will enjoy the multifaceted, interdisciplinary, and diachronic character of this book. *A Hidden Harmony: Mathematics and Music through the Ages* testifies to deep and enduring connections between mathematics and other realms of human creativity.

Vesna Todorčević