The Topos Of Music Geometric Logic Of Concepts Theory And Performance Hardcover

The idea of this monograph is to present an overview of decisive theoretical, computational, technological, aesthetical, artistic, economical, and sociological directions to create future music. It features a unique insight into dominant scientific and artistic new directions, which are guaranteed by the authors' prominent publications in books, software, musical, and dance productions. Applying recent research results from mathematical and computational music theory and software as well as new ideas of embodiment approaches and non-Western music cultures, this book presents new composition methods and technologies. Mathematical, computational, and semiotic models of artistic presence (imaginary time, gestural creativity) as well as strategies are also covered. This book will be of interest to composers, music technicians, and organizers in the internet-based music industry, who are offered concrete conceptual architectures and tools for their future strategies in musical creativity and production.

Now in paper for the first time, Bitter Music is a generous volume of writings by

one of the twentieth century's great musical iconoclasts. Rejecting the equal temperament and concert traditions that have dominated western music, Harry Partch adopted the pure intervals of just intonation and devised a 43-tone-to-the-octave scale, which in turn forced him into inventing numerous musical instruments. His compositions realize his ideal of a corporeal music that unites music, dance, and theater. Winner of the ASCAP-Deems Taylor Award, Bitter Music includes two journals kept by Partch, one while wandering the West Coast during the Depression and the other while hiking the rugged northern California coastline. It also includes essays and discussions by Partch of his own compositions, as well as librettos and scenarios for six major narrative/dramatic compositions.

This text is an upgraded extension of 'Geometrie der Tone', published in 1990. It reflects the dramatic progress of mathematical music theory and its implementation by information technology. The conceptual basis has been generalized to topos-theoretic foundations.

With contributions by numerous experts

In Western Civilization Mathematics and Music have a long and interesting history in common, with several interactions, traditionally associated with the name of Pythagoras but also with a significant number of other mathematicians,

like Leibniz, for instance. Mathematical models can be found for almost all levels of musical activities from composition to sound production by traditional instruments or by digital means. Modern music theory has been incorporating more and more mathematical content during the last decades. This book offers a journey into recent work relating music and mathematics. It contains a large variety of articles, covering the historical aspects, the influence of logic and mathematical thought in composition, perception and understanding of music and the computational aspects of musical sound processing. The authors illustrate the rich and deep interactions that exist between Mathematics and Music. Mathemusical Conversations celebrates the understanding of music through mathematics, and the appreciation of mathematics through music. This volume is a compilation of the invited talks given at the Mathemusical Conversations workshop that took place in Singapore from 13–15 February 2015, organized by Elaine Chew in partnership with Gérard Assayag for the scientific program and with Bernard Lanskey for the artistic program. The contributors are world experts and leading scholars, writing on the intersection of music and mathematics. They also focus on performance and composition, two topics which are foundational both to the understanding of human creativity and to the creation of tomorrow's music technologies. This book is essential reading for researchers in both music

and mathematics. It will also appeal more broadly to scholars, students, musicians, and anyone interested in new perspectives on the intimate relationship between these two universal human activities. Contents:Foreword by Series EditorsForeword by Workshop OrganizersMathemusical Engagement:Without Our Consent (Paul Schoenfield)Approaches to Musical Expression in Harmonix Video Games (Eran Egozy)Motion and Gravitation in the Musical Spheres (Elaine Chew)Mathemusical Creativity:Improvising in Creative Symbolic Interaction (Gérard Assayag)Music, Creativity, and Computers (Margaret A Boden)Tiling Canons as a Key to Approaching Open Mathematical Conjectures? (Moreno Andreatta)Shaping Performance:Musical Motives in Performance: A Study of Absolute Timing Patterns (Neta Spiro, Nicolas Gold and John Rink)Playing with Variables: Anticipating One Particular Performance of Bach's Goldberg Variations (Bernard Lanskey and Stephen Emmerson)The Informatics Philharmonic in the Indiana University Summer String Academy (Christopher Raphael)Educating the Mathemusical:Mathematical Thought and Empirical Approaches in Higher Education in Music (Jian Yang)Action and Symbol: An Essential Tension (Jeanne Bamberger)Educating the Mathemusical: Balancing the Equation (Don McLean)Geometries:Graph-theoretic and Geometric Models of Music (Richard Cohn)In Quest of Musical Vectors (Dmitri

Tymoczko)A Topological Approach of Musical Relationships (Jean-Louis Giavitto and Antoine Spicher)List of Contributors Readership: Advanced secondary school students; post-secondary school students; and scientists, mathematicians, musicians and members of the public interested in the mathematical music sciences.

In this groundbreaking book, Tymoczko uses contemporary geometry to provide a new framework for thinking about music, one that emphasizes the commonalities among styles from Medieval polyphony to contemporary jazz.

At last, a friendly introduction to modern homotopy theory after Joyal and Lurie, reaching advanced tools and starting from scratch.

This Volume II of the Proceedings of the Worldwide Music Conference 2021 continues the line of publications of the first volume in a highly interdisciplinary mode. This time, we offer eight chapters that provide the in-depth study of music in four large sub-fields: mathematics, language and theory of narrative, evolution and perception, and, finally, sociology. The first chapter, by Roman Ruditsa, is devoted to the study of structural pitch organization. This is based upon a formal logical interpretation of the idea of pitch. The chapter contains formal definitions of such objects as tones, intervals, and interval systems and a demonstration of the logical relationships that exist between them. The second chapter, in the same mathematical venue, by Celina Richter and Stefan E.

Schmidt, revisits the millennial question of the essence of an interval, using highly advanced mathematical language, the categories of monoid and the algebraic theory of measurement. The next block is dedicated to language and narrative; the first chapter is by Vincent Meelberg. Here, the reader will find fascinating developments in the ongoing deliberations on this elusive category. The name of Trevor Rawbone, perhaps, does not need an introduction to those involved with cognitive studies of music. This time, his chapter deals with the idea of the language of musical thought, which shifts the traditional discussion of language into a very new dimension. Carlos Almada begins a new section in the book, the one dedicated to evolution and perception. He begins with Darwin and takes us through the exciting path of development of the science of evolution, which he masterfully connects to his model of derivative analysis of music. The question of psycho-physiological foundation of the ethnic hearing, raised in the chapter by lla V. Toropova and Irina N. Simakova, is a difficult one. The idea of ethnic character of music had been a part of traditional musicology and usually was expressed in specific language of humanities. The chapter by Daniil Shutko on the theoretical ideas of the legendary professor of St. Petersburg conservatory, Dr. Tatiana Bershadskaya, was difficult to put into any category. Her concept of music was truly universal and interdisciplinary. At the same time, the concept and Shutkos description are as closely focused on music theory in a narrow and precise sense as possible. The art and culture of consumption of wine in correlation with the choice of music for

listening is a theme for a true connoisseur. It becomes even more intriguing when the authors, Diego Perez-Fuertes, Emma Juaneda-Ayensa and Cristina Olarte-Pascual, add to the discussion the special circumstance of the pandemic and the way human spirit meets this challenge in the most graceful way.

This book constitutes the thoroughly refereed proceedings of the 7th International Conference on Mathematics and Computation in Music, MCM 2019, held in Madrid, Spain, in June 2019. The 22 full papers and 10 short papers presented were carefully reviewed and selected from 48 submissions. The papers feature research that combines mathematics or computation with music theory, music analysis, composition, and performance. They are organized in topical sections on algebraic and other abstract mathematical approaches to understanding musical objects; remanaging Riemann: mathematical music theory as “experimental philosophy”?; octave division; computer-based approaches to composition and score structuring; models for music cognition and beat tracking; pedagogy of mathematical music theory. The chapter “Distant Neighbors and Interscalar Contiguities” is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com.

Algebra and Tiling is a book about how to cover surfaces with shapes.

Questions about variation, similarity, enumeration, and classification of musical structures have long intrigued both musicians and mathematicians. Mathematical models can be found from theoretical analysis to actual composition or sound

production. Increasingly in the last few decades, musical scholarship has incorporated modern mathematical content. One example is the application of methods from Algebraic Combinatorics, or Topology and Graph Theory, to the classification of different musical objects. However, these applications of mathematics in the understanding of music have also led to interesting open problems in mathematics itself. The reach and depth of the contributions on mathematical music theory presented in this volume is significant. Each contribution is in a section within these subjects: (i) Algebraic and Combinatorial Approaches; (ii) Geometric, Topological, and Graph-Theoretical Approaches; and (iii) Distance and Similarity Measures in Music. remove

This volume comprises a selection of papers presented at the first International C-ference on Mathematics and Computation in Music – mcm2007. The conference took place at the Staatliches Institut für Musikforschung PK – National Institute for Music Research in Berlin during May 18–20, 2007 and was jointly organized by the National Institute for Music Research Berlin and the Society of Mathematics and Computation in Music. The papers were selected for the conference by the program committee and classfied into talks and posters. All papers underwent further selection, revision and elaboration for this book publication. The articles cover a research field which is heterogeneous with respect to content, scientific language and methodology. On one hand, this reflects the heterogeneity and richness of the musical subject domain itself.

On the other hand, it exemplifies a t- sion which has been explicitly intended by both the organizers and the founders of the society, namely to support the integration of mathematical and computational - proaches to music theory, composition, analysis and performance. The subdivision into three parts reflects the original structure of the program. These parts are opened by invited papers and followed by talks and posters. According to Grothendieck, the notion of topos is "the bed or deep river where come to be married geometry and algebra, topology and arithmetic, mathematical logic and category theory, the world of the continuous and that of discontinuous or discrete structures." It is what he had "conceived of most broad to perceive with finesse, by the same language rich of geometric resonances, an "essence" which is common to situations most distant from each other, coming from one region or another of the vast universe of mathematical things." The aim of this book is to present a theory and a number of techniques which allow to give substance to Grothendieck's vision by building on the notion of classifying topos educed by categorical logicians. Mathematical theories (formalized within first-order logic) give rise to geometric objects called sites; the passage from sites to their associated toposes embodies the passage from the logical presentation of theories to their mathematical content, i.e. from syntax to semantics. The essential ambiguity given by the fact that any topos is associated in general with an infinite number of theories or different sites allows to study the relations between different theories, and hence the theories themselves, by using toposes as

'bridges' between these different presentations. The expression or calculation of invariants of toposes in terms of the theories associated with them or their sites of definition generates a great number of results and notions varying according to the different types of presentation, giving rise to a veritable mathematical morphogenesis.
Since their discovery hundreds of years ago, people have been fascinated by the wondrous properties of Fibonacci numbers. Being of mathematical significance in their own right, Fibonacci numbers have had an impact on areas like art and architecture, and their traces can be found in nature and even the behavior of the stock market. Starting with the basic properties of Fibonacci numbers, the present book explores their relevance in number theory, the theory of continued fractions, geometry and approximation theory. Rather than giving a complete account of the subject, a few chosen examples are treated exhaustively. They not only reveal the bearing of Fibonacci numbers on mathematics, but also provide very readable marvels of mathematical reasoning. This book is the translation of the 6th Russian edition (the first edition appeared in the early fifties and became a standard source of information on the subject).
After the development of manifolds and algebraic varieties in the previous century, mathematicians and physicists have continued to advance concepts of space. This book and its companion explore various new notions of space, including both formal and conceptual points of view, as presented by leading experts at the New Spaces in

Mathematics and Physics workshop held at the Institut Henri Poincaré in 2015. This volume covers a broad range of topics in mathematical physics, including noncommutative geometry, supergeometry, derived symplectic geometry, higher geometric quantization, intuitionistic quantum logic, problems with the continuum description of spacetime, twistor theory, loop quantum gravity, and geometry in string theory. It is addressed primarily to mathematical physicists and mathematicians, but also to historians and philosophers of these disciplines.

Since precious few architectural drawings and no theoretical treatises on architecture remain from the premodern Islamic world, the Timurid pattern scroll in the collection of the Topkapi Palace Museum Library is an exceedingly rich and valuable source of information. In the course of her in-depth analysis of this scroll dating from the late fifteenth or early sixteenth century, Gülru Necipo?lu throws new light on the conceptualization, recording, and transmission of architectural design in the Islamic world between the tenth and sixteenth centuries. Her text has particularly far-reaching implications for recent discussions on vision, subjectivity, and the semiotics of abstract representation. She also compares the Islamic understanding of geometry with that found in medieval Western art, making this book particularly valuable for all historians and critics of architecture. The scroll, with its 114 individual geometric patterns for

wall surfaces and vaulting, is reproduced entirely in color in this elegant, large-format volume. An extensive catalogue includes illustrations showing the underlying geometries (in the form of incised “dead” drawings) from which the individual patterns are generated. An essay by Mohammad al-Asad discusses the geometry of the muqarnas and demonstrates by means of CAD drawings how one of the scroll’s patterns could be used co design a three-dimensional vault.

Free jazz, as performed by such artists as John Coltrone and Archie Shepp, is a creative, collaborative art form. This book examines free jazz and develops geometric theories of gestures and distributed identities, also known as swarm intelligence.

This book is an introduction to GIS (Generalized Interval Systems) theory that includes the major results of pitch-class theory. It provides mathematicians with applications of group theory to music and music theorists with the essential connections between GIS theory and pitch-class theory. Many of the results in pitch-class theory are not addressed by David Lewin (such as power functions or the Common Tone Theorem for inversions). The book states those results and generalizes them to conform with GIS theory. Finally, it addresses recent criticisms leveled at pitch-class theory and suggests how they can be addressed

in GIS theory.

The mathematical theory of counterpoint was originally aimed at simulating the composition rules described in Johann Joseph Fux's Gradus ad Parnassum. It soon became apparent that the algebraic apparatus used in this model could also serve to define entirely new systems of rules for composition, generated by new choices of consonances and dissonances, which in turn lead to new restrictions governing the succession of intervals. This is the first book bringing together recent developments and perspectives on mathematical counterpoint theory in detail. The authors include recent theoretical results on counterpoint worlds, the extension of counterpoint to microtonal pitch systems, the singular homology of counterpoint models, and the software implementation of contrapuntal models. The book is suitable for graduates and researchers. A good command of algebra is a prerequisite for understanding the construction of the model.

This is the first volume of the second edition of the now classic book "The Topos of Music". The author explains the theory's conceptual framework of denotators and forms, the classification of local and global musical objects, the mathematical models of harmony and counterpoint, and topologies for rhythm and motives.

The Topos of MusicGeometric Logic of Concepts, Theory, and PerformanceBirkhäuser

From the first chapter through the last, readers eager to learn more about the connections between mathematics and music will find a comprehensive textbook designed to satisfy their natural curiosity.

Explores interaction between music and mathematics including harmony, symmetry, digital music and perception of sound.

This book constitutes the refereed proceedings of the Third International Conference on Mathematics and Computation in Music, MCM 2011, held in Paris, France, in June 2011. The 24 revised full papers presented and the 12 short papers were carefully reviewed and selected from 62 submissions. The MCM conference is the flagship conference of the Society for Mathematics and Computation in Music. This year's conference aimed to provide a multi-disciplinary platform dedicated to the communication and exchange of ideas amongst researchers involved in mathematics, computer science, music theory, composition, musicology, or other related disciplines. Areas covered were formalization and geometrical representation of musical structures and processes; mathematical models for music improvisation and gestures theory; set-theoretical and transformational approaches; computational analysis and cognitive musicology as well as more general discussions on history, philosophy and epistemology of music and mathematics.

The original edition of The Geometry of Musical Rhythm was the first book to provide a systematic and accessible computational geometric analysis of the musical rhythms of the world. It explained how the study of the mathematical properties of musical rhythm generates common mathematical problems that arise in a variety of seemingly disparate fields. The book also introduced the distance approach to phylogenetic analysis and illustrated its application to the study of musical rhythm. The new edition retains all of this, while also adding 100 pages, 93 figures, 225 new references, and six new chapters covering topics such as meter and metric complexity, rhythmic grouping, expressive timbre and timing in rhythmic performance, and evolution phylogenetic analysis of ancient Greek paeonic rhythms. In addition, further context is provided to give the reader a fuller and richer insight into the historical connections between music and mathematics.

Algebraic geometry is a fascinating branch of mathematics that combines methods from both, algebra and geometry. It transcends the limited scope of pure algebra by means of geometric construction principles. Moreover, Grothendieck’s schemes invented in the late 1950s allowed the application of algebraic-geometric methods in fields that formerly seemed to be far away from geometry, like algebraic number theory. The new techniques paved the way to

spectacular progress such as the proof of Fermat's Last Theorem by Wiles and Taylor. The scheme-theoretic approach to algebraic geometry is explained for non-experts. More advanced readers can use the book to broaden their view on the subject. A separate part deals with the necessary prerequisites from commutative algebra. On a whole, the book provides a very accessible and self-contained introduction to algebraic geometry, up to a quite advanced level. Every chapter of the book is preceded by a motivating introduction with an informal discussion of the contents. Typical examples and an abundance of exercises illustrate each section. This way the book is an excellent solution for learning by yourself or for complementing knowledge that is already present. It can equally be used as a convenient source for courses and seminars or as supplemental literature.

Contains all the mathematics that computer scientists need to know in one place.

This book represents a new approach to musical creativity, dealing with the semiotics, mathematical principles, and software for creativity processes. After a thorough introduction, the book offers a first practical part with a detailed tutorial for students in composition and improvisation, using musical instruments and music software. The second, theoretical part deals with historical, actual, and new principles of creative processes in music, based on the results and methods

developed in the first author's book Topos of Music and referring to semiotics, predicative objects, topos theory, and object-oriented concept architectures. The third part of the book details four case studies in musical creativity, including an analysis of the six variations of Beethoven's sonata op. 109, a discussion of the creative process in a CD coproduced in 2011 by the first and second authors, a recomposition of Boulez's "Structures pour deux pianos" using the Rubato software module BigBang developed by the third author, and the Escher theorem from mathematical gesture theory in music. This is both a textbook addressed to undergraduate and graduate students of music composition and improvisation, and also a state-of-the-art survey addressed to researchers in creativity studies and music technology. The book contains summaries and end-of-chapter questions, and the authors have used the book as the main reference to teach an undergraduate creativity studies program and also to teach composition. The text is supported throughout with musical score examples.

In this book, first published in 2003, categorical algebra is used to build a foundation for the study of geometry, analysis, and algebra.

A rigorous, axiomatically formulated presentation of the 'zero-square', or 'nilpotent' infinitesimal.

Category theory is unmatched in its ability to organize and layer abstractions and

to find commonalities between structures of all sorts. No longer the exclusive preserve of pure mathematicians, it is now proving itself to be a powerful tool in science, informatics, and industry. By facilitating communication between communities and building rigorous bridges between disparate worlds, applied category theory has the potential to be a major organizing force. This book offers a self-contained tour of applied category theory. Each chapter follows a single thread motivated by a real-world application and discussed with category-theoretic tools. We see data migration as an adjoint functor, electrical circuits in terms of monoidal categories and operads, and collaborative design via enriched profunctors. All the relevant category theory, from simple to sophisticated, is introduced in an accessible way with many examples and exercises, making this an ideal guide even for those without experience of university-level mathematics.
Focusing on topos theory's integration of geometric and logical ideas into the foundations of mathematics and theoretical computer science, this volume explores internal category theory, topologies and sheaves, geometric morphisms, and other subjects. 1977 edition.
Artificial Life, or A-Life, aims at the study of all phenomena characteristic of natural living systems, through computational modeling, wetware-hardware hybrids, and other artificial media. Its scope ranges from the investigation of the

emergence of cognitive processes in natural or artificial systems to the development of life or life-like properties from inorganic components. A number of musicians, in particular composers and musicologists, have started to turn to A-Life for inspiration and working methodology. This edited volume features thirteen chapters written by researchers and practitioners in this exciting emerging field of computer music, and includes a CD with various examples music related to A-Life.

This is the third volume of the second edition of the now classic book “The Topos of Music”. The authors present gesture theory, including a gesture philosophy for music, the mathematics of gestures, concept architectures and software for musical gesture theory, the multiverse perspective which reveals the relationship between gesture theory and the string theory in theoretical physics, and applications of gesture theory to a number of musical themes, including counterpoint, modulation theory, free jazz, Hindustani music, and vocal gestures.

This book presents a deep spectrum of musical, mathematical, physical, and philosophical perspectives that have emerged in this field at the intersection of music and mathematics. In particular the contributed chapters introduce advanced techniques and concepts from modern mathematics and physics, deriving from successes in domains such as Topos theory and physical string

theory. The authors include many of the leading researchers in this domain, and the book will be of value to researchers working in computational music, particularly in the areas of counterpoint, gesture, and Topos theory.
Organized Time is the first attempt to unite theories of harmony, rhythm and meter, and form under a common idea of structured time. Building off of recent advances in music theory in essential subfields-rhythmic theory, tonal structure, and the theory of musical form--author Jason Yust demonstrates that tonal music exhibits similar hierarchical organization in each of these dimensions. Yust develops a network model for temporal structure with an application of mathematical graph theory, which leads ultimately to musical applications of a multi-dimensional polytope called the associahedron. A wealth of analytical examples includes not only the familiar tonal canon-J.S. Bach, Mozart, Schumann--but also lesser known masters of the musical Enlightenment such as C.P.E. and J.C. Bach, Boccherini, and Johann Gottlieb Graun. Yust's approach has wide-ranging ramifications across music theory, enabling new approaches to musical closure, hypermeter, formal function, syncopation, and rhythmic dissonance, as well as historical observations about the development of sonata form and the innovations of Haydn and Beethoven. Making a forceful argument for the independence of musical modalities and for a multivalent approach to

music analysis, Organized Time establishes the aesthetic importance of structural disjunction, the conflict of structure in different modalities, in numerous analytical contexts.

This is the second volume of the second edition of the now classic book “The Topos of Music”. The author explains his theory of musical performance, developed in the language of differential geometry, introducing performance vector fields that generalize tempo and intonation. The author also shows how Rubato, a software platform for composition, analysis, and performance, allows an experimental evaluation of principles of expressive performance theories.

This book discusses all aspects of computing for expressive performance, from the history of CSEMPs to the very latest research, in addition to discussing the fundamental ideas, and key issues and directions for future research. Topics and features: includes review questions at the end of each chapter; presents a survey of systems for real-time interactive control of automatic expressive music performance, including simulated conducting systems; examines two systems in detail, YQX and IMAP, each providing an example of a very different approach; introduces techniques for synthesizing expressive non-piano performances; addresses the challenges found in polyphonic music expression, from a statistical modelling point of view; discusses the automated analysis of musical structure,

and the evaluation of CSEMPs; describes the emerging field of embodied expressive musical performance, devoted to building robots that can expressively perform music with traditional instruments.

This is the fourth volume of the second edition of the now classic book “The Topos of Music”. The author presents appendices with background material on sound and auditory physiology; mathematical basics such as sets, relations, transformations, algebraic geometry, and categories; complements in physics, including a discussion on string theory; and tables with chord classes and modulation steps.