Mathematics And Computation In Music 5th International Conference Mcm 2015 London Uk June 22 25 2015 Proceedings Lecture Notes In Computer Science

An outrageous graphic novel that investigates key concepts in mathematics Integers and permutations—two of the most basic mathematical objects—are born of different fields and analyzed with separate techniques. Yet when the Mathematical Sciences Investigation team of crack forensic mathematicians, led by Professor Gauss, begins its autopsies of the victims of two seemingly unrelated homicides, Arnie Integer and Daisy Permutation, they discover the most extraordinary similarities between the structures of each body. Prime Suspects is a graphic novel that takes you on a voyage of forensic discovery, exploring some of the most fundamental ideas in mathematics. Travel with Detective von Neumann as he leaves no clue unturned, from shepherds' huts in the Pyrenees to secret societies in the cafés of Paris, from the hidden codes in the music of the stones to the grisly discoveries in Finite Fields. Tremble at the ferocity of the believers in deep and rigid abstraction. Feel the frustration—and the excitement—of our young heroine, Emmy Germain, as she blazes a trail for women in mathematical research and learns from Professor Gauss, the greatest forensic detective of them all. Beautifully drawn and exquisitely detailed, Prime Suspects is unique, astonishing, and witty—a once-in-a-lifetime opportunity to experience mathematics like never before.

An Invitation to Applied Mathematics: Differential Equations, Modeling, and Computation introduces the reader to the methodology of modern applied mathematics in modeling, analysis, and scientific computing with emphasis on the use of ordinary and partial differential equations. Each topic is introduced with an attractive physical problem, where a mathematical model is constructed using physical and constitutive laws arising from the conservation of mass, conservation of momentum, or Maxwell's electrodynamics. Relevant mathematical analysis (which might employ vector calculus, Fourier series, nonlinear ODEs, bifurcation theory, perturbation theory, potential theory, control theory, or probability theory) or scientific computing (which might include Newton's method, the method of lines, finite differences, finite elements, finite volumes, boundary elements, projection methods, smoothed particle hydrodynamics, or Lagrangian methods) is developed in context and used to make physically significant predictions. The target audience is advanced undergraduates (who have at least a working knowledge of vector calculus and linear ordinary differential equations) or beginning graduate students. Readers will gain a solid and exciting introduction to modeling, mathematical analysis, and computation that provides the key ideas and skills needed to enter the wider world of modern applied mathematics. Presents an integrated wealth of modeling, analysis, and numerical methods in one volume Provides practical and comprehensible introductions to complex subjects, for example, conservation laws, CFD, SPH, BEM, and FEM Includes a rich set of applications, with more appealing problems and projects suggested

How music has influenced mathematics, physics, and astronomy from ancient Greece to the twentieth century Music is filled with mathematical elements. The works of Bach are often said to possess a math-like logic, and Arnold Schoenberg, Iannis Xenakis, and Karlheinz Stockhausen wrote music explicitly based on mathematical principles. Yet Eli Maor argues that it is music that has had the greater influence on mathematics, not the other way around. Starting with Pythagoras, proceeding through Schoenberg, and bringing the story up to the present with contemporary string theory, Music by the Numbers tells a fascinating story of composers, scientists, inventors, and eccentrics who have played a role in the age-old relationship between music, mathematics, and the physical sciences. Weaving compelling stories of historical episodes with Maor's personal reflections as a mathematician and lover of classical music, this book will delight anyone who loves math and music.

From the Preface: Blending ideas from operations research, music psychology, music theory, and cognitive science, this book aims to tell a coherent story of how tonality pervades our experience, and hence our models, of music. The story is told through the developmental stages of the Spiral Array model for tonality, a geometric model designed to incorporate and represent principles of tonal cognition, thereby lending itself to practical applications of tonal recognition, segmentation, and visualization. Mathematically speaking, the coils that make up the Spiral Array model are in effect helices, a spiral referring to a curve emanating from a central point. The use of "spiral" here is inspired by spiral staircases, intertwined spiral staircases: nested double helices within an outer spiral. The book serves as a compilation of knowledge about the Spiral Array model and its applications, and is written for a broad audience, ranging from the layperson interested in music, mathematics, and computing to the music scientist-engineer interested in computational approaches to music representation and analysis, from the music-mathematical and computational sciences student interested in learning about tonality from a formal modeling standpoint to the computer musician interested in applying these technologies in interactive composition and performance. Some chapters assume no musical or technical knowledge, and some are more musically or computationally involved.

This book constitutes the thoroughly refereed proceedings of the Fourth International Conference on Mathematics and Computation in Music, MCM 2013, held in Montreal, Canada, in June 2013. The 18 papers presented were carefully reviewed and selected from numerous submissions. They are promoting the collaboration and exchange of ideas among researchers in music theory, mathematics, computer science, musicology, cognition and other related fields.

This book constitutes the thoroughly refereed proceedings of the 5th International Conference on Mathematics and Computation in Music, MCM 2015, held in London, UK, in June 2015. The 24 full papers and 14 short papers presented were carefully reviewed and selected from 64 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 notation and representation, music generation, patterns, performance, similarity and contrast, post-tonal music analysis, geometric approaches, deep learning, and scales.

Computational Mathematics in Engineering and Applied Science provides numerical algorithms and associated software for solving a spectrum of problems in ordinary differential equations (ODEs), differential algebraic equations (DAEs), and partial differential equations (PDEs) that occur in science and engineering. It presents detailed examples, each

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.

Over the last few decades the interest of logicians and mathematicians in constructive and computational aspects of their subjects has been steadily growing, and researchers from disparate areas realized that they can benefit enormously from the mutual exchange of techniques concerned with those aspects. A key figure in this exciting development is the logician and mathematician Helmut Schwichtenberg to whom this volume is dedicated on the occasion of his 70th birthday and his turning emeritus. The volume contains 20 articles from leading experts about recent developments in Constructive set theory, Provably recursive functions, Program extraction, Theories of truth, Constructive mathematics, Classical vs. intuitionistic logic, Inductive definitions, and Continuous functionals and domains.

Thirty years ago mathematical, as opposed to applied numerical, computation was difficult to perform and so relatively little used. Three threads changed that: the emergence of the personal computer; the discovery of fiber-optics and the consequent development of the modern internet; and the building of the Three “M’s” Maple, Mathematica and Matlab. We intend to persuade that Mathematica and other similar tools are worth knowing, assuming only that one wishes to be a mathematician, a mathematics educator, a computer scientist, an engineer or scientist, or anyone else who wishes/needs to use mathematics better. We also hope to explain how to become an "experimental mathematician" while learning to be better at proving things. To accomplish this our material is divided into three main chapters followed by a postscript. These cover elementary number theory, calculus of one and several variables, introductory linear algebra, and visualization and interactive geometric computation.

This book explains the state of the art in the use of the discrete Fourier transform (DFT) of musical structures such as rhythms or scales. In particular the author explains the DFT of pitch-class distributions, homometry and the phase retrieval problem, nil Fourier coefficients and tilings, saliency, extrapolation to the continuous Fourier transform and continuous spaces, and the meaning of the phases of Fourier coefficients. This is the first textbook dedicated to this subject, and with supporting examples and exercises this is suitable for researchers and advanced undergraduate and graduate students of music, computer science and engineering. The author has made online supplementary material available, and the book is also suitable for practitioners who want to learn about techniques for understanding musical notions and who want to gain musical insights into mathematical problems.

The Digital Da Vinci book series opens with the interviews of music mogul Quincy Jones, MP3 inventor Karlheinz Brandenburg, Tommy Boy founder Tom Silverman and entertainment attorney Jay L. Cooper. A strong supporter of science, technology, engineering and mathematics programs in schools, The Black Eyed Peas founding member will.i.am announced in July 2013 his plan to study computer science. Leonardo da Vinci, the epitome of a Renaissance man, was an Italian polymath at the turn of the 16th century. Since the Industrial Revolution in the 18th century, the division of labor has brought forth specialization in the workforce and university curriculums. The endangered species of polymaths is facing extinction. Computer science has come to the rescue by enabling practitioners to accomplish more than ever in the field of music. In this book, Newton Lee recounts his journey in executive producing a Billboard-charting song like managing agile software development; M. Nyssim Lefford expounds producing and its effect on vocal recordings; Dennis Reidsma, Mustafa Radha and Anton Nijholt survey the field of mediated musical interaction and musical expression; Isaac Schankler, Elaine Chew and Alexandre François describe improvising with digital auto-scaffolding; Shlomo Dubnov and Greg Surges explain the use of musical algorithms in machine listening and composition; Juan Pablo Bello discusses machine listening of music; Stephen and Tim Barrass make smart things growl, purr and sing; Raffaella Folgieri, Mattia Bergomi and Simone Castellani examine EEG-based brain-computer interface for emotional involvement in games through music and last but not least, Kai Ton Chau concludes the book with computer and music pedagogy. Digital Da Vinci: Computers in Music is dedicated to polymathic education and interdisciplinary studies in the digital age empowered by computer science. Educators and researchers ought to encourage the new generation of scholars to become as well rounded as a Renaissance man or woman.

Musical Sense-Making: Enaction, Experience, and Computation broadens the scope of musical sense-making from a disembodied cognitivist approach to an experiential approach. Revolving around the definition of music as a temporal and sounding art, it argues for an interactional and experiential approach that brings together the richness of sensory experience and principles of cognitive economy. Starting from the major distinction between in-time and outside-of-time processing of the sounds, this volume provides a conceptual and operational framework for dealing with sounds in a real-time listening situation, relying heavily on the theoretical groundings of ecology, cybernetics, and systems theory, and stressing the role of epistemic interactions with the sounds. These interactions are considered from different perspectives, bringing together insights from previous theoretical groundings and more recent empirical research. The author’s findings are framed within the context of the broader field of enactive and embodied cognition, recent action and perception studies, and the emerging field of neurophenomenology and dynamical systems theory. This volume will particularly appeal to scholars and researchers interested in the intersection between music, philosophy, and/or psychology.

Teach Your Students How to Use Computing to Explore Powerful and Creative Ideas In the twenty-first century, computers have become indispensable in music making, distribution, performance, and consumption. Making Music with Computers: Creative Programming in Python introduces important concepts and skills necessary to generate music with computers. It interweaves computing pedagogy with musical concepts and creative activities, showing students how to integrate the creativity and design of the arts with the mathematical rigor and formality of computer science. The book provides an introduction to creative software development in the Python programming language. It uses innovative music-creation activities to illustrate introductory computer programming concepts, including data types, algorithms, operators, iteration, lists, functions, and classes. The authors also cover GUIs, event-driven programming, big data, sonification, MIDI programming, client–server programming, recursion, fractals, and complex system dynamics. Requiring minimal musical or programming experience, the text is designed for courses in introductory computer science and computing in the arts. It helps students learn computer programming in a creative context and understand how to build computer music applications. Also suitable for self-study, the book shows musicians and digital music enthusiasts how to write music software and create algorithmic music compositions. Web Resource A supplementary website (http://jythonMusic.org) provides a music library and other software resources used in the text. The music library is an extension of the jMusic library and incorporates other cross-platform programming tools. The website also offers example course and associated media resources.

With the ongoing development of algorithmic composition programs and communities of practice expanding, algorithmic music faces a turning point. Joining dozens of emerging and established scholars alongside leading practitioners in the field, chapters in this Handbook both describe the state of algorithmic composition and also set the agenda for critical research on and analysis of algorithmic music. Organized into four sections, chapters explore the music's history, utility, community, politics, and potential for mass consumption. Contributors address such issues as the role of algorithms as co-performers, live coding practices, and discussions of the algorithmic culture as it currently exists and what it can potentially contribute society, education, and ecommerce. Chapters engage particularly with post-human perspectives - what new musics are now being found through algorithmic means which humans could not otherwise have made - and, in reciprocation, how

algorithmic music is being assimilated back into human culture and what meanings it subsequently takes. Blending technical, artistic, cultural, and scientific viewpoints, this Handbook positions algorithmic music making as an essentially human activity.

Computational approaches to music composition and style imitation have engaged musicians, music scholars, and computer scientists since the early days of computing. Music generation research has generally employed one of two strategies: knowledge-based methods that model style through explicitly formalized rules, and data mining methods that apply machine learning to induce statistical models of musical style. The five chapters in this book illustrate the range of tasks and design choices in current music generation research applying machine learning techniques and highlighting recurring research issues such as training data, music representation, candidate generation, and evaluation. The contributions focus on different aspects of modeling and generating music, including melody, chord sequences, ornamentation, and dynamics. Models are induced from audio data or symbolic data. This book was originally published as a special issue of the Journal of Mathematics and Music.

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.

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

This book constitutes the refereed proceedings of the Second International Conference on Mathematics and Computation in Music, MCM 2009, held in New Haven, CT, USA, in June 2009. The 26 revised full papers presented were carefully reviewed and selected from 38 submissions. The MCM conference is the flagship conference of the Society for Mathematics and Computation in Music. The papers deal with topics within applied mathematics, computational models, mathematical modelling and various further aspects of the theory of music. This year’s conference is dedicated to the honor of John Clough whose research modeled the virtues of collaborative work across the disciplines.

This book constitutes the thoroughly refereed proceedings of the 6th International Conference on Mathematics and Computation in Music, MCM 2017, held in Mexico City, Mexico, in June 2017. The 26 full papers and 2 short papers presented were carefully reviewed and selected from 40 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 models, computer assisted performance, Fourier analysis, Gesture Theory, Graph Theory and Combinatorics, Machine Learning, and Probability and Statistics in Musical Analysis and Composition.

Pendragon Press is proud to offer this new, revised, and expanded edition of Formalized Music, Iannis Xenakis's landmark book of 1971. In addition to three totally new chapters examining recent breakthroughs in music theory, two original computer programs illustrating the actual realization of newly proposed methods of composition, and an appendix of the very latest developments of stochastic synthesis as an invitation to future exploration, Xenakis offers a very critical self-examination of his theoretical propositions and artistic output of the past thirty-five years. This edition of Formalized Music is an essential tool for understanding the man and the thought processes of one of this century's most important and revolutionary musical figures.

The fundamental mathematical tools needed to understand machine learning include linear algebra, analytic geometry, matrix decompositions, vector calculus, optimization, probability and statistics. These topics are traditionally taught in disparate courses, making it hard for data science or computer science students, or professionals, to efficiently learn the mathematics. This self-contained textbook bridges the gap between mathematical and machine learning texts, introducing the mathematical concepts with a minimum of prerequisites. It uses these concepts to derive four central machine learning methods: linear regression, principal component analysis, Gaussian mixture models and support vector machines. For students and others with a mathematical background, these derivations provide a starting point to machine learning texts. For those learning the mathematics for the first time, the methods help build intuition and practical experience with applying mathematical concepts. Every chapter includes worked examples and exercises to test understanding. Programming tutorials are offered on the book's web site.

This book covers elementary discrete mathematics for computer science and engineering. It emphasizes mathematical definitions and proofs as well as applicable methods. Topics include formal logic notation, proof methods; induction, well-ordering; sets, relations; elementary graph theory; integer congruences; asymptotic notation and growth of functions; permutations and combinations, counting principles; discrete probability. Further selected topics may also be covered, such as recursive definition and structural induction; state machines and invariants; recurrences; generating functions.

The authors show that there are underlying mathematical reasons for why games and puzzles are challenging (and perhaps why they are so much fun). They also show that games and puzzles can serve as powerful models of computation-quite different from the usual models of automata and circuits-offering a new way of thinking about computation. The appen

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.

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.

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.

“Science is art,” said Regina Dugan, senior executive at Google and former director of DARPA. “It is the process of creating something that never exists before. ... It makes us ask new questions about ourselves, others; about ethics, the future.” This second volume of the Digital Da Vinci book series leads the discussions on the world’s first computer art in the 1950s and the actualization of Star Trek’s holodeck in the future with the help of artificial intelligence and cyborgs. In this book, Gavin Sade describes experimental creative practices that bring together arts, science and technology in imaginative ways; Mine Özkar expounds visual computation for good designs based on repetition and variation; Raffaella Folgieri, Claudio Lucchiari, Marco Granato and Daniele Grechi introduce BrainArt, a brain-computer interface that allows users to create drawings using their own cerebral rhythms; Nathan Cohen explores artificially created spaces that enhance spatial awareness and challenge our perception of what we encounter; Keith Armstrong discusses embodied experiences that affect the mind and body of participating audiences; Diomidis Spinellis uses Etoys and Squeak in a scientific experiment to teach the concept of physical computing; Benjamin Cowley explains the massively multiplayer online game “Green My Place” aimed at achieving behavior transformation in energy awareness; Robert Niewiadomski and Dennis Anderson portray 3-D manufacturing as the beginning of common creativity revolution; Stephen Barrass takes 3-D printing to another dimension by fabricating an object from a sound recording; Mari Velonaki examines the element of surprise and touch sensing in human-robot interaction; and Roman Danylak surveys the media machines in light of Marshall McLuhan’s dictum “the medium is the message.” Digital Da Vinci: Computers in the Arts and Sciences is dedicated to polymathic education and interdisciplinary studies in the digital age empowered by computer science. Educators and researchers ought to encourage the new generation of scholars to become as well rounded as a Renaissance man or woman.

Mathematics and Computation in MusicFirst International Conference, MCM 2007, Berlin, Germany, May 18-20, 2007. Revised Selected PapersSpringer

At first glance, mathematics and music seem to be from separate worlds—one from science, one from art. But in fact, the connections between the two go back thousands of years, such as Pythagoras’s ideas about how to quantify changes of pitch for musical tones (musical intervals). Mathematics and Music: Composition, Perception, and Performance explores the many links between mathematics and different genres of music, deepening students’ understanding of music through mathematics. In an accessible way, the text teaches the basics of reading music and explains how various patterns in music can be described with mathematics. The authors extensively use the powerful time-frequency method of spectrograms to analyze the sounds created in musical performance. Numerous examples of music notation assist students in understanding basic musical scores. The text also provides mathematical explanations for musical scales, harmony, and rhythm and includes a concise introduction to digital audio synthesis. Along with helping students master some fundamental mathematics, this book gives them a deeper appreciation of music by showing how music is informed by both its mathematical and aesthetic structures. Web Resource On the book’s CRC Press web page, students can access videos of many of the spectrograms discussed in the text as well as musical scores playable with the free music software MuseScore. An online bibliography offers many links to free downloadable articles on math and music. The web page also provides links to other websites related to math and music, including all the sites mentioned in the book.

This book is of interest for students of mathematics or of neighboring subjects like physics, engineering, computer science, and also for people who have at least school level mathematics and have kept some interest in it. Also good for younger readers just reaching their final school year of mathematics.

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.

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.

With contributions by numerous experts

An introduction to computational complexity theory, its connections and interactions with mathematics, and its central role in the natural and social sciences, technology, and philosophy Mathematics and Computation provides a broad, conceptual overview of computational complexity theory—the mathematical study of efficient computation. With important practical applications to computer science and industry, computational complexity theory has evolved into a highly interdisciplinary field, with strong links to most mathematical areas and to a growing number of scientific endeavors. Avi Wigderson takes a sweeping survey of complexity theory, emphasizing the field’s insights and challenges. He explains the ideas and motivations leading to key models, notions, and results. In particular, he looks at algorithms and complexity, computations and proofs, randomness and interaction, quantum and arithmetic computation, and cryptography and learning, all as parts of a cohesive whole with numerous cross-influences. Wigderson illustrates the immense breadth of the field, its beauty and richness, and its diverse and growing interactions with other areas of mathematics. He ends with a comprehensive look at the theory of computation, its methodology and aspirations, and the unique and fundamental ways in which it has shaped and will further shape science, technology, and society. For further reading, an extensive bibliography is provided for all topics covered. Mathematics and Computation is useful for undergraduate and graduate students in mathematics, computer science, and related fields, as well as researchers and teachers in these fields. Many parts require little background, and serve as an invitation to newcomers seeking an introduction to the theory of computation. Comprehensive coverage of computational complexity theory, and beyond High-level, intuitive exposition, which brings conceptual clarity to this central and dynamic scientific discipline Historical accounts of the evolution and motivations of central concepts and models A broad view of the theory of computation's influence on science, technology, and society Extensive bibliography

Focuses on the role of the computer as a generative tool for music composition. Miranda introduces a number of computer music composition techniques ranging from probabilities, formal grammars and fractals, to genetic algorithms, cellular automata and neural computation. Anyone wishing to use the computer as a companion to create music will find this book a valuable resource. As a comprehensive guide with full explanations of technical terms, it is suitable for students, professionals and enthusiasts alike. The accompanying CD-ROM contains examples, complementary tutorials and a number of composition systems for PC and Macintosh platforms, from demonstration versions of commercial programs to exciting, fully working packages developed by research centres world-wide, including Nyquist, Bol Processor, Music Sketcher, SSEYO Koan, Open Music and the IBVA brainwaves control system, among others. This book will be interesting to anyone wishing to use the computer as a companion to create music. It is a comprehensive guide, but the technical terms are explained so it is suitable for students, professionals and enthusiasts alike.