
Elias Zafiris

Mathematical Thinking

An Involution for Architects

TU Wien
Academic Press



MERIDIAN ARCHITECTONICS

Volume 2

Meridian Architectonics book series edited by:

Prof. Vera Bühlmann and Dr. Riccardo M. Villa

Research Unit of Architecture Theory and Philosophy of Technics

Faculty of Architecture and Planning

TU Wien, Karlsplatz 13, 1040 Wien

Information on this book series and the volumes published therein is available at
www.tuwien.ac.at/academicpress and at atp.tuwien.ac.at.



RESEARCH UNIT OF
ARCHITECTURE THEORY AND
PHILOSOPHY OF TECHNICS

Elias Zafiris

Mathematical Thinking

An Involution for Architects



TU Wien
Academic Press

Media proprietor
TU Wien
Karlsplatz 13, 1040 Wien

Publisher
TU Wien Academic Press
c/o TU Wien Bibliothek
TU Wien
Resselgasse 4, 1040 Wien
academicpress@tuwien.ac.at
www.tuwien.at/academicpress

Author (responsible for the content)
Elias Zafiris

Layout and cover design
Cris Argüelles
We would like to thank Philipp Kitzberger and Franziska Weber
for assisting with the graphic design and layout.

Production
Ferdinand Berger & Söhne GmbH

TU Wien Academic Press 2025



This work is licensed under CC BY-SA 4.0.
To view a copy of this license, visit <https://creativecommons.org/licenses/by-sa/4.0/>

Any third-party material in this book is not covered by the book's Creative Commons licence. Details of the copyright ownership and permitted use of third-party material are given in the image credit lines or references. If you would like to reuse any third-party material not covered by the book's Creative Commons licence, you will need to obtain permission directly from the copyright owner.

ISBN (print): 978-3-85448-074-7
ISBN (online): 978-3-85448-075-4
ISSN (print): 2960-5334
ISSN (online): 2960-5342

Available online: <https://doi.org/10.34727/2025/isbn.978-3-85448-075-4>

Cite as
Zafiris, E. (2025). *Mathematical thinking: An involution for architects*.
TU Wien Academic Press. <https://doi.org/10.34727/2025/isbn.978-3-85448-075-4>

MERIDIAN



ARCHITECTONICS

Contents

Foreword: Nature in Nuptials, Orphean Quests and the Portico of the Arts

by Vera Bühlmann

1. Wondering and Wandering around the Vortex

Abstraction and Diachronicity	41
Bridges in Time: Metaphora and Modular Substitution	43
The Threefold: Philosophy—Mathematics—Architectonics	48
Domain of Communication	49
The Central Obstacle—The Inconceivable	50
Utopia—Doxa—Paradox	51
Logos—Utopia—Praxis	52
Arche—Architectonics—Architecture	52
Abduction—Induction—Deduction	53
Dissociation—Metaphora—Association	54
Abstraction—Percolation—Invariance	55
Stability in Vorticity: Static Tripod	57

2. Mathematical Weaving of the Cosmos

Congruence and Invariance	61
Architectonics of Natural Communication	66
Harmonic Analysis and Synthesis	69
Armonia-Arithmos-Arche	76
Synchronization and Unveiling	77
Meander and Rhythm	78
Architectonic Scaffolding	80
Bounding the Rhetorical Topos	83
The Gnomon: Logos Bound to Proportion as Ratio	85
The Monochord: Logos Bound to Harmonics as Integer	90
The Harmonic Scale: Genesis of Incommensurability	96
The Tempering Screen: Logos Bound to Spectrum as Chroma	112

3. The Devil of Algebra: The Time Art of Adjoining and Inverting

Structure and Symbol	121
Conjugation: The Algebra of Metaphora	123
Monoids of Natural Numbers	126
Digital Gnomons: Primes and Fundamental Theorem	129
Language of Algebra	131
Group Structure on the Integers	132
Commutative Action of a Group and Symmetry	142
Ambiguity—Objective Probability—Information	144
Extension of Scalarity from the Integers to the Rationals	147
Structural Metaphora: Adjunction—Partition—Quotient	152
The Bridges of Forgetfulness and Remembrance	153
Modular Substitution of Neutral Element: The Evasion of Self-Reference	154
Homomorphism and Modulation of Neutrality by Ideals	157
Powers and Double Invertibility: Extraction of Roots and Logarithms	161

4. The Transcendental Realm of Eternity: Abduction of Space from Time

The Irrationals: Cuts on the Arithmetic Line	171
Abduction of Space from Eternity via Ordering	177

The Method of Exhaustion: Bounding and Converging to the Limit	178
Completing the Arithmetic Cosmos: Extension by Imaginaries	182
Vectorial Representation of Complex Numbers	187
Polar Representation and the Complex Exponential	188
Quantum Neutrality: Abduction of Space from Eternity by Phasing	191
The Spiral and the Catenary Natural Bridges	195
The Meteoron of the Catenary Arch	200
Surfaces of Revolution and Curvature	202
Helicoid: The Minimal Surface Bridge from Harmonics to Geometry	207
Self-Interference: The Spectral Resolution of Time	211
Logarithmic Branching	214
Canon of Metamorphosis and Modular Substitution	217
The Archimedean Spiral Bridge of Circle Rectification	220
The Helix and the Imaginary Axis of Archimedes	224
Harmonics of the Screw: The Area-Preserving Projection of the Sphere	228
The Resonating Screen: Equatorial Cyclotomy	231

5. The Mediator of Analysis Situs: Continuity and Connectivity

Topological Plasticity: The Erasure of Distance	235
The Euler Characteristic Invariant of Shape	237
Continuity and Information: Localization and Sheaves	241
The Plastic Metamorphosis of the Gnomon	246
Multi-Connectivity: The Fundamental Group of Contraction Invariance	252
The Universal Covering of the Circle by the Helix	254

6. The Angel of Geometry: The Space Art of Angles and Areas

Metronomy of Euclidean Elements: Geometric Topos	257
Parallelism—Orthogonality—Homeothesis	261
Invariance of Angles and Areas	265
Geometric Mean and the Pythagorean Theorem	268
Translation-Rotation-Area: Space Synchronization	273

Harmonic Parallel Transport	278
Conic Sections	280
Trapezium Invariance of Double Cone and Equiangular Spiral	285
Optical and Acoustic Symptoms of the Conics	287
Kepler Laws in Momentum Space and Unification of Conics	288
Mechanics: Fulcrum and Archimedean Law of the Lever	295
Reciprocals and Invariance of Area	297
The Uncertainty Principle of Light: Symplectic Optics	300
Differential Calculus: Tangent Slope and Integration Area	302
Neutral Geometric Element: The Real Exponential Function	304
Integration Areas and Color: The Natural Logarithm Function	309

7. The Pneuma of Stochastics: Quantum Phase and Thermal Spectrum

Helicoidal Universal Covering and Branch Cutting	321
Imaginary Potentiation of Angles through Phases	324
Imaginary Geometry of Quantum Phases	330
Neutrality Condition: The Universal Equation of Ciphers	336
Principle of the Imaginary Rolling Wheel	339
Imaginary Rotation and Real Tempering: The π -Tuning	341
Imaginary Polar Spider Web Cyclotomy: Windings and Quanta	347
Area Homology: Complex Logarithm and Residue Calculus	352
Area Plasticity and the Architectonic Inside-Outside Distinction	357
Digitalization: Probability and the Abduction of Area from Space	362
Imaginary Time Arc: Potentiation of Angles on the Hyperbola	367
Real Reciprocal Phases and Duplication of Areas	370
Arithmetic Mean Synchronization of Branches	372
Imaginary Time and Constant Light Velocity: Special Relativity	374
Imaginary Time and Heat of Color: Quantization and Temperature	380
Thermal Quantum Spectrum of Hyperbola and Incandescence	381

Bibliography 385

Illustrations 387