
Contents

	<i>Prologue</i>	<i>page xi</i>
	<i>Acknowledgements</i>	xx
1	Introduction	1
	1.1 Transcendence	1
	1.2 Relations Between Periods	2
	1.3 Dimensions of Period Spaces	4
	1.4 Method of Proof	7
	1.5 Why 1-Motives?	8
	1.6 The Case of Elliptic Curves	8
	1.7 Values of Hypergeometric Functions	9
	1.8 Structure of the Monograph	10
	PART ONE FOUNDATIONS	13
2	Basics on Categories	15
	2.1 Additive and Abelian Categories	15
	2.2 Subcategories	17
	2.3 Functors	18
3	Homology and Cohomology	21
	3.1 Singular Homology	21
	3.2 Algebraic de Rham Cohomology	24
	3.3 The Period Pairing	29
4	Commutative Algebraic Groups	31
	4.1 The Building Blocks	31
	4.2 Group Extensions	33

viii	<i>Contents</i>	
	4.3	Semi-abelian Varieties 37
	4.4	Universal Vector Extensions 39
	4.5	Generalised Jacobians 40
5	Lie Groups	43
	5.1	The Lie Algebra 43
	5.2	The Exponential Map 44
	5.3	Integration over Paths 45
6	The Analytic Subgroup Theorem	48
	6.1	The Statement 48
	6.2	Analytic vs Algebraic Homomorphisms 50
7	The Formalism of the Period Conjecture	54
	7.1	Periods 54
	7.2	The Period Conjecture 59
	PART TWO PERIODS OF DELIGNE 1-MOTIVES	67
8	Deligne's 1-Motives	69
	8.1	The Category and the Realisation Functors 69
	8.2	The Functor to Mixed Hodge Structures 75
	8.3	The Key Comparison 79
9	Periods of 1-Motives	82
	9.1	Definition and First Properties 82
	9.2	Relations Between Periods 84
	9.3	Transcendence of Periods of 1-Motives 87
	9.4	Fullness 89
10	First Examples	93
	10.1	Squaring the Circle 93
	10.2	Transcendence of Logarithms 95
	10.3	Hilbert's Seventh Problem 97
	10.4	Abelian Periods for Closed Paths 99
11	On Non-closed Elliptic Periods	101
	11.1	The Setting 101
	11.2	Without CM 102
	11.3	The CM-Case 104
	11.4	Transcendence 106

<i>Contents</i>		ix
PART THREE PERIODS OF ALGEBRAIC VARIETIES		109
12	Periods of Algebraic Varieties	111
	12.1 Spaces of Cohomological 1-Periods	111
	12.2 Periods of Curve Type	112
	12.3 Comparison with Periods of 1-Motives	115
	12.4 The Motivic Point of View	117
13	Relations Between Periods	120
	13.1 Kontsevich's Period Conjecture	120
	13.2 The Case of Curves	123
14	Vanishing of Periods of Curves	128
	14.1 Classical Periods	128
	14.2 The Setting	130
	14.3 Forms of the First Kind	134
	14.4 Forms of the Second Kind	136
	14.5 Forms of the Third Kind	138
	14.6 Arbitrary Differential Forms	140
	14.7 Vanishing of Simple Periods	141
 PART FOUR DIMENSIONS OF PERIOD SPACES		 145
15	Dimension Computations: An Estimate	147
	15.1 Set-up and Terminology	147
	15.2 The Saturated Case	150
	15.3 Special Cases	155
	15.4 Proof of the Dimension Estimate	159
16	Structure of the Period Space	163
17	Incomplete Periods of the Third Kind	167
	17.1 Relation Spaces	167
	17.2 Alternative Description of $\delta_{\text{inc}3}(M)$	174
18	Elliptic Curves	178
	18.1 Classical Theory of Periods	178
	18.2 Elliptic Periods	181
	18.3 A Calculation	183
	18.4 Transcendence of Incomplete Periods	184
	18.5 Elliptic Period Space	186
19	Values of Hypergeometric Functions	191
	19.1 Elliptic Integrals	191
	19.2 Abelian Integrals	197

PART FIVE APPENDICES	207
<i>Appendix A</i> Nori Motives	209
<i>Appendix B</i> Voevodsky Motives	217
<i>Appendix C</i> Comparison of Realisations	221
<i>List of Notation</i>	229
<i>References</i>	235
<i>Index</i>	241