

# Contents

Introduction	vii
<b>Part 1. From Bounded Domains to Symmetric Banach Manifolds</b>	<b>1</b>
Chapter 1. Analytic manifolds and their automorphism groups	3
1.1. Analytic manifolds and analytic germs	3
1.2. Vector fields and one-parameter groups	7
1.3. Restrictions and extensions of vector fields	16
Chapter 2. Uniform manifolds and their automorphism groups	19
2.1. Locally uniform manifolds and their automorphisms	19
2.2. Groups of locally uniform transformations	21
Chapter 3. The semigroup $\mathcal{O}_c(X)$ of holomorphic contractions	37
3.1. Cartan's uniqueness theorem. Algebraic version	37
3.2. The set $\mathcal{O}(D)$ of selfmaps as a topological semigroup	39
3.3. Cartan's uniqueness theorem. Topological version	43
3.4. The semigroup $\mathcal{O}_c(X)$ of holomorphic contractions in $X$	48
Chapter 4. Manifolds with a compatible invariant metric	53
4.1. Invariant locally compatible metrics in a manifold	53
4.2. Cartan's uniqueness theorem in manifolds	56
4.3. $\text{Aut}(X, d)$ as a group of locally uniform transformations	59
4.4. $\text{Aut}(X, d)$ as a group of analytic transformations	65
Chapter 5. Manifolds with a compatible tangent norm	75
5.1. Tangent norm and integrated metrics in a manifold	75
5.2. Normed manifolds	78
5.3. Infinitesimal version of Cartan's uniqueness theorem	85
5.4. Construction of compatible invariant norms	89
Chapter 6. Symmetric normed manifolds	93
6.1. Symmetric normed manifolds	93
6.2. The adjoint action $\text{Ad}(s_a)$ on the Lie algebra $\mathfrak{g}(X)$	95
6.3. Homogeneity of symmetric normed manifolds	97
Chapter 7. $J^*$ -triples and their related Lie algebras	101
7.1. The category of Jordan-Banach triple systems	101
7.2. The subcategory of $J^*$ -triples	105
7.3. Binary Banach-Lie algebras	106
7.4. Lie algebras associated with a $J^*$ -triple	109

Chapter 8. The $J^*$ -triple associated with a symmetric manifold	117
8.1. The canonical chart of a symmetric manifold	117
8.2. The $J^*$ -triple associated to a symmetric normed manifold	121
8.3. Construction of the canonical functor	122
Chapter 9. The symmetric manifold associated with a $J^*$ -triple	127
9.1. The quotient manifold $G/H$	128
9.2. The canonical action of $G$ on $G/H$	130
9.3. The immersion $E \hookrightarrow G/H$ of $E$ into the manifold $G/H$	132
9.4. The symmetric manifold associated with a $J^*$ -triple	133
9.5. Examples: $J^*$ -algebras and classical Cartan factors	138
<b>Part 2. Finite Rank <math>J^*</math>-triples and <math>JH^*</math>-triples</b>	<b>147</b>
Chapter 10. Algebraic study of $J^*$ -triples	149
10.1. Tripotents in a $J^*$ -triple. Peirce decomposition	149
10.2. Compatibility in a $J^*$ -triple	152
10.3. Orthogonality in a $J^*$ -triple	153
10.4. Orthogonal families. Joint Peirce decomposition	159
10.5. Ideals and inner ideals in a $J^*$ -triple	162
10.6. Nilpotency and Jacobson radical of a $J^*$ -triple	172
Chapter 11. Atomic $J^*$ -triples and $JH^*$ -triples	175
11.1. Finite rank $J^*$ -triples. Construction of the trace form	175
11.2. Finite rank $J^*$ -triples. $J^*$ -isomorphic classification	177
11.3. Hilbertian triple systems or $JH^*$ -triples	192
11.4. Hermitian symmetric manifolds	203
<b>Part 3. From Symmetric Banach Manifolds to <math>JB^*</math>-Triples</b>	<b>207</b>
Chapter 12. Spectral properties and bounded $J^*$ -triples	209
12.1. Spectral properties of $J^*$ -triples	209
12.2. Anisotropy and the spectral seminorm in a $J^*$ -triple	211
12.3. Bounded $J^*$ -triples and the Carathéodory metrics	213
12.4. Abelian $J^*$ -triples	216
Chapter 13. The Riemann mapping theorem for $JB^*$ -triples	219
13.1. Monogeneous $J^*$ -triples. The Jordan representation	219
13.2. The manifold associated to a monogeneous $J^*$ -subtriple	219
13.3. The manifold of a monogeneous $J^*$ -triple, revisited	226
13.4. Bounded $J^*$ -triples and the Riemann mapping theorem	229
Chapter 14. The category of $JB^*$ -triples	237
14.1. Gelfand theory for abelian $J^*$ -triples	237
14.2. $JB^*$ -triples. Uniqueness of the structure	245
14.3. Products and quotients of $JB^*$ -triples	248
14.4. The projection theorem	252
14.5. Ultraproducts of $JB^*$ -triples	253
14.6. The bidual of a $JB^*$ -triple	255

Chapter 15.	Automorphisms of bounded symmetric domains	257
15.1.	Jordan families and $J^*$ -triples	257
15.2.	Integration of certain vector fields	258
15.3.	The manifold associated with a $JB^*$ -triple, revisited	268
15.4.	Examples: Automorphisms of the unit ball in Cartan factors	276
15.5.	Behaviour of automorphisms at the boundary of the ball	278
Chapter 16.	Tripotents in $JB^*$ -triples	283
16.1.	Existence of non-zero tripotents in $JB^*$ -triples	283
16.2.	$JB^*$ -triples and their related $JB^*$ -algebras	283
16.3.	Peirce projectors in $JB^*$ -triples	287
16.4.	Order relation in the set of tripotents	290
16.5.	Regular tripotents and extreme points	295
16.6.	Examples: Tripotents in $J^*$ -algebras and Cartan factors	299
Chapter 17.	Functional calculus in a $JB^*$ -triple. Applications	315
17.1.	The odd functional calculus	315
17.2.	The structure group of a $JB^*$ -triple	317
17.3.	Invertible elements in a $JB^*$ -triple	320
17.4.	The structure group of the $JB^*$ -triple $\mathcal{C}(\Omega)$	322
Chapter 18.	Automorphisms of Banach-Grassmann manifolds	325
18.1.	Banach-Grassmann manifolds	325
18.2.	The group of collineations of a Grassmann manifold	329
18.3.	Collineations of Hilbert-Grassmann manifolds	333
18.4.	Correlations of Grassmann manifolds	336
18.5.	Holomorphic vector fields in Hilbert-Grassmann manifolds	339
18.6.	Groups of automorphisms of Grassmann manifolds	346
Chapter 19.	Symmetric Grassmann manifolds over Hilbert spaces	353
19.1.	The dual manifolds of the classical symmetric manifolds $\mathbf{I}_{n,m}$	353
19.2.	An alternative description of the unit ball $\mathfrak{A}_0$	354
19.3.	Complete vector fields on the symmetric manifolds $\mathbf{I}_{n,m}$	356
19.4.	Isometries of rectangular Cartan factors $\mathbf{I}_{n,m}$	357
19.5.	The symmetric dual manifolds of $\mathbf{II}_n$ and $\mathbf{III}_n$	358
19.6.	Complete vector fields on the manifolds $\mathbf{II}_n$ and $\mathbf{III}_n$	361
19.7.	Isometries of Cartan factors $\mathbf{II}_n$ and $\mathbf{III}_n$	363
19.8.	Complex quadrics. The symmetric dual manifold of $\mathbf{IV}_n$	364
19.9.	The quadrics $\mathbf{Q}_n$ as the symmetric dual manifold of $\mathbf{IV}_n$	368
19.10.	Isometries of Cartan factors of type $\mathbf{IV}_n$	372
Chapter 20.	Affine structure of the unit ball in a $JB^*$ -triple	375
20.1.	Affine structure of the unit ball in a Banach space	375
20.2.	Affine structure of the unit ball of a $JB^*$ -triple	380
20.3.	Boundaries, stable and determining subsets in $JB^*$ -triples	388
20.4.	The dynamic system associated to a $JB^*$ -triple	392
20.5.	The manifold of tripotents in a $JB^*$ -triple	393

<b>Part 4. JB*-triples in Dual Banach Spaces or JBW*-triples</b>	<b>397</b>
Chapter 21. JB*-triples in dual Banach spaces	399
21.1. Definition and elementary properties of JBW*-triples	399
21.2. Characterisation of the predual of a JBW*-triple	404
21.3. Uniqueness of the predual of a JBW*-triple	406
21.4. Separate w*-w*-continuity and uniqueness of the predual	411
21.5. The bidual of a JB*-triple is a JBW*-triple	416
21.6. Separate w*-w*-continuity of the triple product in a JBW*-triple	421
21.7. Examples: Cartan factors are JBW*-triples	423
Chapter 22. Structure theory for JBW*-triples and their preduals	425
22.1. w*-closed ideals in a JBW*-triple	425
22.2. Representations of JB*-triples	434
22.3. Ideals in JB*-algebras and JB*-triples	440
22.4. Normal functionals on a JBW*-triple	441
22.5. Atomic and non-atomic ideals of a JBW*-triple	447
22.6. The Gelfand-Naimark theorem	456
22.7. Normal representations of JBW*-triples	460
Chapter 23. Facial structure in JBW*-triples and in JB*-triples	467
23.1. Facial structure of convex sets	467
23.2. Facial structure of the unit ball in Banach spaces	471
23.3. Facial structure of the predual of a JBW-algebra	474
23.4. Support of an element in a JBW*-triple	475
23.5. Facial structure of the predual of a JBW*-triple	481
Chapter 24. The strong and strong* topologies in JBW*-triples	493
24.1. The strong* topology in JBW*-triples	493
24.2. The strong topology in JB*-triples	501
24.3. Behaviour of the strong and the strong* topologies	503
24.4. Admissible topologies and holomorphic automorphisms	506
Chapter 25. Derivations of JB*-triples	511
25.1. Automatic continuity of derivations	511
25.2. Existence of outer derivations	513
25.3. Approximation by inner derivations	521
Appendix A. Some results on functional analysis	527
A.1. Monogeneous J*-triples. The Gelfand representation	527
A.2. Derivations of the Banach-Lie algebra $\mathcal{L}(E)$	535
A.3. Isomorphisms of the Banach algebra $\mathcal{L}(E)$	540
List of symbols and their meanings	543
Bibliography	547
Index	557