

Contents

Overview	1
1 Geotensors	11
1.1 Linear Space	11
1.2 Autovector Space	18
1.3 Oriented Autoparallel Segments on a Manifold	31
1.4 Lie Group Manifolds	41
1.5 Geotensors	75
2 Tangent Autoparallel Mappings	79
2.1 Declinative (Autovector Spaces)	81
2.2 Declinative (Connection Manifolds)	87
2.3 Example: Mappings from Linear Spaces into Lie Groups	92
2.4 Example: Mappings Between Lie Groups	100
2.5 Covariant Declinative	102
3 Quantities and Measurable Qualities	105
3.1 One-dimensional Quality Spaces	107
3.2 Space-Time	118
3.3 Vectors and Tensors	122
4 Intrinsic Physical Theories	125
4.1 Intrinsic Laws in Physics	125
4.2 Example: Law of Heat Conduction	126
4.3 Example: Ideal Elasticity	133
A Appendices	153
Bibliography	251
Index	257

List of Appendices

A.1	Adjoint and Transpose of a Linear Operator	153
A.2	Elementary Properties of Groups (in Additive Notation)	157
A.3	Troupe Series	158
A.4	Cayley-Hamilton Theorem	161
A.5	Function of a Matrix	162
A.6	Logarithmic Image of $SL(2)$	169
A.7	Logarithmic Image of $SO(3)$	171
A.8	Central Matrix Subsets as Autovector Spaces	173
A.9	Geometric Sum on a Manifold	174
A.10	Bianchi Identities	180
A.11	Total Riemann Versus Metric Curvature	182
A.12	Basic Geometry of $GL(n)$	184
A.13	Lie Groups as Groups of Transformations	203
A.14	$SO(3)$ – 3D Euclidean Rotations	207
A.15	$SO(3,1)$ – Lorentz Transformations	217
A.16	Coordinates over $SL(2)$	222
A.17	Autoparallel Interpolation Between Two Points	223
A.18	Trajectory on a Lie Group Manifold	224
A.19	Geometry of the Concentration–Dilution Manifold	228
A.20	Dynamics of a Particle	231
A.21	Basic Notation for Deformation Theory	233
A.22	Isotropic Four-indices Tensor	237
A.23	9D Representation of Fourth Rank Symmetric Tensors	238
A.24	Rotation of Strain and Stress	241
A.25	Macro-rotations, Micro-rotations, and Strain	242
A.26	Elastic Energy Density	243
A.27	Saint-Venant Conditions	247
A.28	Electromagnetism versus Elasticity	249

Elements for Physics

Quantities, Qualities, and Intrinsic Theories

Tarantola, A.

2006, XIV, 266 p. 44 illus., 10 illus. in color., Hardcover

ISBN: 978-3-540-25302-0