

Index

- Banach manifold, 24
- Bastiani calculus, 7, 203
- Boman's theorem, 202
- bornology, 202
- bump function, 195
- Butcher group, 185
- Butcher–Connes–Kreimer algebra, 182

- canonical manifold of mappings, 41, 219
- carrier of a function, 195
- chain rule, 11, 19, 21
- change of charts, 16
- character group of a Hopf algebra, 178
- character of an algebra, 177
- Chen's relation, 160, 167, 168
- Christoffel symbol, 91
- CIA
 - see* continuous inverse algebra, 49
- compact open C^∞ -topology, 4, 30, 192, 198, 221
- compact open topology, 13, 208
- continuous inverse algebra, 49
 - unit group, 49
- continuous projection, 194
- convenient calculus, 202
- convenient smooth map, 202
- coordinate projection, 11
- cotangent bundle, 21, 81
- current group, 72
- curvature, 96, 100
 - Bianchi identity, 101
 - sectional, 151
- curve
 - c -parallel, 99
 - energy of a, 84, 222
 - length of a, 84
 - passing through a point, 19
 - piecewise C^1 , 84
 - principal part of a, 99
 - smooth, 2
- derivation of an algebra, 227, 230
- derivative
 - covariant, 94
 - covariant, along a map, 109
 - directional, 7
 - iterated directional, 8
 - left logarithmic, 62, 238
 - Lie derivative, 227, 236
 - metric derivative, 97
 - of a manifold-valued curve, 22
- diffeomorphism group, 35, 50, 120
 - acting n -transitive, 121
 - canonical action, ix, 51
 - contactomorphisms, 52
 - stabiliser of a point, 121
 - symplectomorphisms, 52
 - volume-preserving, 52, 144, 242
- differential form, 231, 240
 - (locally) integrable, 237
 - Lie derivative, 236
 - preserved by a diffeomorphism, 52
 - pullback, 235
 - volume form, 241
- dual space, 4, 83, 193

- embedding, 23
 - set of, 34
- equation of Lie type, 60
- Euler equations
 - Eulerian form, 143
 - Lagrangian form, 145

- Euler–Arnold equation, 152
- Euler–Poincaré equation, 149
- evaluation map, 39, 210
- evolution map, 62
- exponential law, 39, 211
- exterior differential, 232

- fibre product (of manifolds), 27
- final topology, 206
- flip of the double tangent bundle, 215
- formal power series, 183
- Fréchet calculus, 14
- Fréchet space, 3, 198
- Fundamental theorem of calculus, 5

- geodesic, 88, 100, 139
 - of a spray, 92
 - of the L^2 -metric, 112
- geodesic distance, 85
 - non-vanishing, 86
- geodesic equation, 92, 99
- gradient, 143, 242
- Grossman’s ellipsoid, 103
- group of bisections, 126
 - vertical bisections, 130
- group of gauge transformations, 77

- Hölder continuity, 169
- Hahn–Banach theorem, 4
- half-Lie group, 155
- Hilbert sphere, 16, 83
- homogeneous space, 77, 183
- Hopf algebra, 177
- Hopf–Rinow theorem, 102
- Hunter–Saxton equation, 153

- immersion, 23
 - naïve, 24
 - set of, 33
- infinitesimally injective (or surjective), 24
- initial topology, 206

- Kolmogorov’s normability criterion, 192

- Lie algebra, 55
 - associated to a Lie group, 57
 - current algebra, 72
 - Jacobi identity, 55
 - locally convex, 56
 - of (left-)invariant vector fields, 56
 - of divergence-free vector fields, 243
 - of vector fields, 228

- Lie bracket, 55
 - of vector fields, 56
 - trivial, 56
- Lie group, 48
 - Bourbaki construction principle, 70
 - exponential, 65
 - exponential coordinates, 66
 - left- (right-)translation, 48
 - Lie subgroup, 52
 - locally exponential, 66
 - regular (in the sense of Milnor), 62
 - semidirect product, 54
 - semiregular, 62
 - split exact sequence, 54
 - tangent Lie group, 53
- Lie group action, 51
 - adjoint action, 60
- Lie groupoid, 125
 - action groupoid, 127
 - bisection action groupoid, 134
 - current groupoid, 128
 - enough bisections, 135
 - gauge groupoid, 128
 - pair groupoid, 127
 - tangent groupoid, 132
 - unit groupoid, 127
 - vertex group, 125
- Lie polynomial, 164
- Lie series, 164
- Lie theorems, 60
- local addition, 43, 213
 - normalised, 218
- local-to-global argument, 196
- loop group, 74
- Lyons lift, 170
- Lyons’ lifting theorem, 170

- Mackey complete, 5, 187, 202
- manifold atlas, 16
- manifold chart, 16
- Maurer–Cartan form, 237
- mean value theorem, 9
- Minkowski functional, 83, 192
- multiplicative functional, 168, 179

- Neumann inversion formula, 161

- Omori’s theorem, ix, 155
- orbifold, 124, 127

- partition of unity, 195
- pre-shape space, 114

- principal bundle, 76, 129
 - gauge group, 76
 - structure group, 76
- pro-Lie group, 166
- product manifold, 17
- pullback, 31, 45, 209
- pushforward, 13, 31, 43, 209
- Riemann–Stieltjes sum, 157, 158
- Riemannian metric
 - H^1 -metric, 113
 - \dot{H}^1 -semimetric, 153
 - L^2 -metric, 81, 108, 140
 - co-orthogonal structure, 102
 - elastic metric, 116
 - invariant L^2 -metric, 83, 88, 89, 144
 - pullback metric, 116
 - right/left invariant, 87
 - robust, 101
 - strong, 81
 - weak, 80
- rough norm, 197
- rough path, 170
 - branched, 181, 183
 - Brownian motion, 171
 - set of weakly geometric, 170
 - weakly geometric, 170
- rule on partial differentials, 9, 22
- Schwartz' theorem, 8, 12
- seminorm, 3
 - basis condition, 191
 - fundamental system of, 191
 - generating family of, 3
 - separating family of, 190
- shape analysis, 106
- shape space, 114
- shuffle algebra, 176, 183
- signature of a smooth path, 162
- smooth variation, 138
 - right-shifted, 146
- space
 - C^k -paracompact, 196
 - C^k -regular, 196
 - complemented subspace, 194
 - convenient vector space, 202
 - locally convex, 3, 192
 - metrisable, 3
 - of Hölder continuous functions, 169
 - of smooth p -forms, 232
 - sequentially closed, 12
 - short exact sequence, 25
 - topological vector space, 1, 186
- spray, 91
 - associated covariant derivative, 95
 - connector, 96
 - metric, 92
 - metric spray, 97
- square root velocity transform, 116
- SRVT
 - see* square root velocity transform, 116
- Stacey–Roberts Lemma, 45
- standard simplex (Δ), 168
- submanifold, 17
 - split, 17
- submersion, 23
 - naïve, 24
 - set of, 33
- support of a function, 195
- tangent bundle, 19
- tangent map, 21
- tangent space, 19
- tangent vector (geometric), 19
- tensor algebra, 160
- topology of compact
 - convergence, 208
- transversal, 26
- unit group (of an algebra), 49
- vector bundle, 215
 - direct product, 217
 - dual bundle, 21, 81
 - pullback, 216
 - set of all sections, 215
 - smooth section, 215
 - Whitney sum, 217, 220
- vector bundle morphism, 215
- vector field, 225
 - (left) invariant, 56, 64
 - along a smooth map, 109
 - complete, 64
 - divergence, 143, 242
 - flow, 226
 - Helmholtz decomposition, 242
 - integral curve, 226
 - Lie bracket, 226
 - local representative, 225
 - principal part, 225

- related, 226
- second-order, 91
- vector space of, 225
- vector topology, 1
 - generated by seminorms, 3
- Volterra series, 63, 162
- weak integral, 4
- wedge product, 234
- Young integral, 158
- zero-section, 43, 213, 220