Contents

Pı	eface		V
C	ontents		XIII
1	Jet p	rolongations of fibred manifolds	1
	1.1	The rank theorem	1
	1.2	Fibred manifolds	6
	1.3	The contact of differentiable mappings	10
	1.4	Jet prolongations of fibred manifolds	12
	1.5	The horizontalization	16
	1.6	Jet prolongations of automorphisms of fibred manifolds	18
	1.7	Jet prolongations of vector fields	22
	Refe	erences	31
2	Diffe	rential forms on jet prolongations of	
_		d manifolds	32
	2.1	The contact ideal	32
	2.2	The trace decomposition	39
	2.3	The horizontalization	49
	2.4	The canonical decomposition	54
	2.5	Contact components and geometric operations	62
	2.6	Strongly contact forms	63
	2.7	Fibred homotopy operators on jet prolongations of	
		fibred manifolds	68
	Refe	erences	78

3	Form	al divergence equations	79
	3.1	Formal divergence equations	79
	3.2	Integrability of formal divergence equations	83
	3.3	Projectable extensions of differential forms	87
	Ref	erences	94
4	Varia	tional structures	94
	4.1	Variational structures on fibred manifolds	95
		Variational derivatives	98
		Lepage forms	102
		Euler-Lagrange forms	113
		Lepage equivalents and the Euler-Lagrange mapping	114 118
		The first variation formula Extremals	120
		Trivial Lagrangians	120
		Source forms and the Vainberg-Tonti Lagrangians	124
		The inverse problem of the calculus of variations	134
		Local variationality of second-order source forms	144
	Ref	erences	153
5	Invar	iant variational structures	155
	5.1	Invariant differential forms	156
	5.2	Invariant Lagrangians and conservation equations	157
		Invariant Euler-Lagrange form	162
	5.4	Symmetries of extremals and Jacobi vector fields	164
	Ref	erences	170
6	Examples: Natural Lagrange structures		171
	6.1	The Hilbert variational functional	171
		Natural Lagrange structures	178
	6.3	Connections	181
	Ref	erences	183
7	Elem	entary sheaf theory	185
		Sheaf spaces	185
	7.2	Abelian sheaf spaces	190
	7.3	Sections of Abelian sheaf spaces	194
	7.4	Abelian presheaves	196
	7.5	Sheaf spaces associated with Abelian presheaves	200
	7.6	Sheaves associated with Abelian presheaves	204
	7.7	Sequences of Abelian groups, complexes	209
	7.8	Exact sequences of Abelian sheaves	220

	7.0	Cahamalaay arayna af a shaaf	
		Cohomology groups of a sheaf Sheaves over paracompact Hausdorff spaces	231
	Refe	erences	242
8	Varia	tional sequences	243
	8.1	The contact sequence	244
		The variational sequence	251
		Variational projectors	253
		The Euler-Lagrange morphisms	266
	8.5	Variationally trivial Lagrangians	274
	8.6	Global inverse problem of the calculus of variations	275
	Refe	erences	278
Αr	pendi	X	
	•		
	•	on Euclidean spaces and smooth manifolds	279
	•	on Euclidean spaces and smooth manifolds	279 279
	alysis		
	nalysis	on Euclidean spaces and smooth manifolds Jets of mappings of Euclidean spaces	279
	nalysis 1 2 3	on Euclidean spaces and smooth manifolds Jets of mappings of Euclidean spaces Summation conventions	279 280
	1 2 3 4	on Euclidean spaces and smooth manifolds Jets of mappings of Euclidean spaces Summation conventions The rank theorem	279 280 285
	1 2 3 4 5	on Euclidean spaces and smooth manifolds Jets of mappings of Euclidean spaces Summation conventions The rank theorem Local flows of vector fields	279 280 285 286
	1 2 3 4 5	on Euclidean spaces and smooth manifolds Jets of mappings of Euclidean spaces Summation conventions The rank theorem Local flows of vector fields Calculus on manifolds	279 280 285 286 287
	1 2 3 4 5 6 7	Jets of mappings of Euclidean spaces Summation conventions The rank theorem Local flows of vector fields Calculus on manifolds Fibred homotopy operators	279 280 285 286 287 290
	1 2 3 4 5 6 7	Jets of mappings of Euclidean spaces Summation conventions The rank theorem Local flows of vector fields Calculus on manifolds Fibred homotopy operators Differential ideals	279 280 285 286 287 290 299
	1 2 3 4 5 6 7 8	Jets of mappings of Euclidean spaces Summation conventions The rank theorem Local flows of vector fields Calculus on manifolds Fibred homotopy operators Differential ideals The Levi-Civita symbol	279 280 285 286 287 290 299 300
Ar	1 2 3 4 5 6 7 8 9	Jets of mappings of Euclidean spaces Summation conventions The rank theorem Local flows of vector fields Calculus on manifolds Fibred homotopy operators Differential ideals The Levi-Civita symbol The trace decomposition Bases of forms	279 280 285 286 287 290 299 300 304 313
Ar	1 2 3 4 5 6 7 8	Jets of mappings of Euclidean spaces Summation conventions The rank theorem Local flows of vector fields Calculus on manifolds Fibred homotopy operators Differential ideals The Levi-Civita symbol The trace decomposition Bases of forms	279 280 285 286 287 290 299 300 304