

CONTENTS

Introduction	1
---------------------	---

I FOUNDATIONS

1 From classical to modern	11
1.1 Hamiltonian mechanics	12
1.2 The symplectic topology of Euclidean space	28
2 Linear symplectic geometry	37
2.1 Symplectic vector spaces	38
2.2 The symplectic linear group	43
2.3 Lagrangian subspaces	50
2.4 The affine nonsqueezing theorem	55
2.5 Complex structures	61
2.6 Symplectic vector bundles	68
3 Symplectic manifolds	81
3.1 Basic concepts	81
3.2 Isotopies and Darboux's theorem	93
3.3 Submanifolds of symplectic manifolds	99
3.4 Contact structures	105
4 Almost complex structures	117
4.1 Almost complex structures	117
4.2 Integrability	123
4.3 Kähler manifolds	130
4.4 J -holomorphic curves	141

II SYMPLECTIC MANIFOLDS

5 Symplectic group actions	151
5.1 Circle actions	151
5.2 Moment maps	161
5.3 Examples	165
5.4 Symplectic quotients	173
5.5 Convexity	179
5.6 Localization	191

6	Symplectic Fibrations	197
6.1	Symplectic fibrations	197
6.2	Symplectic 2-sphere bundles	202
6.3	Symplectic connections	207
6.4	Hamiltonian holonomy and the coupling form	215
6.5	Hamiltonian fibrations	226
7	Constructing Symplectic Manifolds	233
7.1	Blowing up and down	233
7.2	Connected sums	251
7.3	The telescope construction	257

III SYMPLECTOMORPHISMS

8	Area-preserving diffeomorphisms	265
8.1	Periodic orbits	265
8.2	The Poincaré–Birkhoff theorem	269
8.3	The billiard problem	275
9	Generating functions	280
9.1	Generating functions of type S	280
9.2	Discrete Hamiltonian mechanics	288
9.3	Hamiltonian symplectomorphisms	293
9.4	Lagrangian submanifolds	303
10	The group of symplectomorphisms	311
10.1	Basic properties	311
10.2	The flux homomorphism	315
10.3	The Calabi homomorphism	328
10.4	The topology of symplectomorphism groups	333

IV SYMPLECTIC INVARIANTS

11	The Arnold conjecture	339
11.1	Symplectic fixed points	340
11.2	Morse theory and the Conley index	346
11.3	Lagrangian intersections	357
11.4	Floer homology	366
12	Symplectic capacities	371
12.1	Nonsqueezing and capacities	371
12.2	Rigidity	377
12.3	The Hofer metric	380

12.4	The Hofer–Zehnder capacity	394
12.5	A variational argument	401
13	New directions	417
13.1	Various examples	419
13.2	Symplectic structures on closed manifolds	434
13.3	Symplectic 4-manifolds	439
13.4	Symplectic submanifolds	450
	References	458
	Index	473