
Bibliography

- Abarbanel, H.D.I. and D.D. Holm [1987], Nonlinear stability analysis of inviscid flows in three dimensions: incompressible fluids and barotropic fluids, *Phys. Fluids*, **30**, 3369–3382.
- Abarbanel, H.D.I., D.D. Holm, J.E. Marsden, and T.S. Ratiu [1986], Nonlinear stability analysis of stratified fluid equilibria, *Phil. Trans. Roy. Soc. London A*, **318**, 349–409.
- Abraham, R. and J.E. Marsden [1978], *Foundations of Mechanics*. Benjamin-Cummings Publ. Co, Updated 1985 version, reprinted by Perseus Publishing, second edition. Available online at http://www.cds.caltech.edu/~marsden/books/Foundations_of_Mechanics.html.
- Abraham, R., J.E. Marsden, and T.S. Ratiu [1988], *Manifolds, Tensor Analysis, and Applications*. Applied Mathematical Sciences, volume 75. Springer-Verlag.
- Adams, J.F. [1969], *Lectures on Lie Groups*, The University of Chicago Press.
- Ahlfors, L. [1961], Some remarks on Teichmüller’s space of Riemann surfaces, *Ann. of Math.*, **74**, 171–191.
- Ahlfors, L. [1962], Curvature properties of Teichmüller’s space, *J. Analyse Math.*, **9**, 161–176.
- Alber, M.S., G.G. Luther, J.E. Marsden, and J.M. Robbins [1998], Geometric phases, reduction and Lie-Poisson structure for the resonant three-wave interaction, *Physica D*, **123**, 271–290.
- Alekseev, A., A. Malkin, and E. Meinrenken [1998], Lie group valued momentum maps. *J. Differential Geom.*, **48**, 445–495.

- Arms, J. [1979], Linearization stability of gravitational and gauge fields, *J. Math. Phys.*, **20**, 443–453.
- Arms, J.M., R.H. Cushman, and M.J. Gotay [1991], A universal reduction procedure for Hamiltonian group actions, In *The Geometry of Hamiltonian Systems*, T.S. Ratiu ed., 33–51, Springer Verlag.
- Arms, J.M., J.E. Marsden, and V. Moncrief [1981], Symmetry and bifurcations of momentum mappings, *Comm. Math. Phys.*, **78**, 455–478.
- Arms, J.M., J.E. Marsden, and V. Moncrief [1982], The structure of the space solutions of Einstein’s equations: II Several Killings fields and the Einstein–Yang–Mills equations, *Ann. of Phys.*, **144**, 81–106.
- Arnold, V.I. [1966a], Sur la géométrie différentielle des groupes de Lie de dimension infinie et ses applications à l’hydrodynamique des fluides parfaits, *Ann. Inst. Fourier, Grenoble*, **16**, 319–361.
- Arnold, V.I. [1966b], Sur un principe variationnel pour les écoulements stationnaires des liquides parfaits et ses applications aux problèmes de stabilité non linéaires, *J. Mécanique*, **5**, 29–43.
- Arnold, V.I. [1969], On an a priori estimate in the theory of hydrodynamical stability, *Amer. Math. Soc. Transl.*, **79**, 267–269.
- Arnold, V.I., V.V. Kozlov, and A.I. Neishtadt [1988], *Mathematical Aspects of Classical and Celestial Mechanics*, in *Dynamical Systems III*, V.I. Arnold, ed., Springer-Verlag, third edition, 2006.
- Arnold, V.I. [1989], *Mathematical Methods of Classical Mechanics*, Graduate Texts in Math., volume 60, Springer-Verlag, Second edition.
- Atiyah, M. [1982], Convexity and commuting Hamiltonians, *Bull. London Math. Soc.*, **14**, 1–5.
- Atiyah, M.F. and R. Bott [1982], The Yang-Mills equations over Riemann surfaces, *Phil. Trans. R. Soc. Lond. A*, **308**, 523–615.
- Atiyah, M. and R. Bott [1984], The moment map and equivariant cohomology, *Topology*, **23**, 1–28.
- Baguis, P. [1998] Semidirect products and the Pukanszky condition, *J. Geom. and Phys.* **25**, 245–270.
- Balog, J., L. Fehér and L. Palla [1998], Coadjoint orbits of the Virasoro algebra and the global Liouville equation, *Int. J. Mod. Phys.*, **A 13**, 315–362.
- Bates, L. and E. Lerman [1997], Proper group actions and symplectic stratified spaces. *Pacific J. Math.*, **181**, 201–229.
- Bates, L. and J. Śniatycki [1993], Nonholonomic reduction, *Reports on Math. Phys.*, **32**, 99–115.

- Bayen, F., M. Flato, C. Fronsdal, A. Lichnerowicz, and D. Sternheimer [1978], Deformation theory and quantization. I. Deformations of symplectic structures, *Ann. Physics*, **111**, 61–110; part II on pages 111–151.
- Benenti, S. and W. Tulczyjew [1985], Momentum relations for Hamiltonian group actions, *Géométrie symplectique et mécanique*, 12–29.
- Bers, L. [1965], Automorphic forms and general Teichmüller spaces, *Proc. Conf. Complex Analysis (Minneapolis 1964)*, Springer, Berlin 1965, 109–113.
- Bers, L. [1970], Universal Teichmüller space, in *Analytic methods in mathematical physics (Sympos., Indiana Univ., Bloomington, Ind., 1968)*, 65–83. Gordon and Breach, New York.
- Bhaskara, K.H. [1990], Affine Poisson structures, *Proc. Indian Academy of Sci.*, **100**, 189–202.
- Binz, E., J. Śniatycki, and H. Fischer [1988], *Geometry of Classical Fields*, volume 154 of *North-Holland Mathematics Studies*, North-Holland Publishing Co., Amsterdam.
- Birtea, P., M. Puta, T.S. Ratiu, and R. Tudoran [2005], Symmetry breaking for toral actions in simple mechanical systems, *J. Diff. Eqns.*, **216**, 282–323.
- Blankenstein, G. and A.J. van der Schaft [2001], Symmetry and reduction in implicit generalized Hamiltonian systems, *Rep. Math. Phys.* **47**, 57–100.
- Blaom, A.D. [2000], Reconstruction phases via Poisson reduction, *Diff. Geom. and Appl.*, **12**, 231–252.
- Blaom, A.D. [2001], A geometric setting for Hamiltonian perturbation theory, *Mem. Amer. Math. Soc.*, volume 153, number 727. Providence, R.I.
- Bleecker, D. [1981], *Gauge Theory and Variational Principles*, *Global Analysis Pure and Applied Series A*, volume 1, Addison-Wesley Publishing Co., Reading, Mass.
- Bloch, A. (with the collaboration of J. Ballieul, P. Crouch, and J.E. Marsden) [2003], *Nonholonomic Mechanics and Control*, *Interdisciplinary Applied Mathematics*, volume 24. Springer-Verlag.
- Bloch, A.M. and P.E. Crouch [1994], Reduction of Euler–Lagrange problems for constrained variational problems and relation with optimal control problems, *Proc. CDC*, **33**, 2584–2590. IEEE.
- Bloch, A.M., P.E. Crouch, J.E. Marsden, and T.S. Ratiu [2000], An almost Poisson structure for the generalized rigid body equations, *IFAC Proceedings*, 0-08-043658-7, March 2000.
- Bloch, A.M., P. Crouch, J.E. Marsden, and T.S. Ratiu [2002], The symmetric representation of the rigid body equations and their discretization, *Nonlinearity*, **15**, 1309–1341.

- Bloch, A.M., P.S. Krishnaprasad, J.E. Marsden, and R. Murray [1996], Nonholonomic mechanical systems with symmetry, *Arch. Rational Mech. Anal.*, **136**, 21–99.
- Bloch, A.M., P.S. Krishnaprasad, J.E. Marsden, and T.S. Ratiu [1994], Dissipation induced instabilities, *Ann. Inst. H. Poincaré, Analyse Nonlinéaire*, **11**, 37–90.
- Bloch, A.M., P.S. Krishnaprasad, J.E. Marsden and T.S. Ratiu [1996], The Euler–Poincaré equations and double bracket dissipation, *Comm. Math. Phys.*, **175**, 1–42.
- Bloch, A.M. and J.E. Marsden [1990], Stabilization of rigid body dynamics by the energy–Casimir method, *Systems Control Lett.*, **14**, 341–346.
- Bobenko, A.I., A.G. Reyman, and M.A. Semenov-Tian-Shansky [1989], The Kowalewski top 99 years later: A Lax pair, generalizations and explicit solutions, *Comm. Math. Phys.*, **122**, 321–354.
- Bobenko, A. and Y. Suris [1999], Discrete Lagrangian reduction, discrete Euler–Poincaré equations, and semidirect products, *Letters in Mathematical Physics*, **49**, 79–93.
- Born, M. [1927], *The Mechanics of the Atom*. G. Bells and Sons, Ltd., London.
- Bott, R. [1977], On the characteristic classes of groups of diffeomorphisms, *Enseign. Math.*, **23**.
- Bourbaki, N. [1971], *Lie Groups and Lie Algebras. Chapters 1–3*, Springer-Verlag, Berlin, 1998. Translated from the 1971 French edition.
- Bredon, G.E. [1972] *Introduction to Compact Transformation Groups*. Academic Press.
- Bretherton, F.P. [1970], A note on Hamilton’s principle for perfect fluids, *J. Fluid Mech.*, **44**, 19–31.
- Brouwer, D. and G.M. Clemence [1961], *Methods of Celestial Mechanics*, Academic Press, New York.
- Camassa, R. and D.D. Holm [1993], An integrable shallow water equation with peaked solitons, *Phys. Rev. Lett.*, **71**, 1661–1664.
- Cannas da Silva, A. and A. Weinstein [1999], *Geometric Models for Noncommutative Algebras*, Berkeley Math. Lecture Notes, volume 10. Amer. Math. Soc.
- Cartan, É. [1922], *Leçons sur les Invariants Intégraux*, Hermann.
- Cartan, H. and S. Eilenberg [1956], *Homological Algebra*, Princeton University Press.
- Castrillón López, M., P.L. García Pérez, and T.S. Ratiu [2001], Euler–Poincaré reduction on principal bundles, *Lett. Math. Phys.*, **58**, 167–180.

- Castrillón López, M. and J.E. Marsden [2003], Some remarks on Lagrangian and Poisson reduction for field theories, *J. Geom. Phys.*, **48**(1), 52–83.
- Castrillón López, M. and T.S. Ratiu [2003], Reduction in principal bundles: covariant Lagrange-Poincaré equations, *Comm. Math. Phys.* **236**(2), 223–250.
- Castrillón López, M., T.S. Ratiu, and S. Shkoller [2000], Reduction in principal fiber bundles: Covariant Euler-Poincaré equations, *Proc. Amer. Math. Soc.*, **128**, 2155–2164.
- Cendra, H., D.D. Holm, M.J.W. Hoyle, and J.E. Marsden [1998], The Maxwell–Vlasov equations in Euler–Poincaré form, *J. Math. Phys.*, **39**, 3138–3157.
- Cendra, H., D.D. Holm, J.E. Marsden, and T. S. Ratiu [1998], Lagrangian reduction, the Euler–Poincaré equations and semidirect products, *Amer. Math. Soc. Transl.*, **186**, 1–25.
- Cendra, H., A. Ibort, and J.E. Marsden [1987], Variational principal fiber bundles: a geometric theory of Clebsch potentials and Lin constraints, *J. Geom. Phys.*, **4**, 183–206.
- Cendra, H. and J.E. Marsden [1987], Lin constraints, Clebsch potentials and variational principles, *Physica D*, **27**, 63–89.
- Cendra, H., J.E. Marsden, S. Pekarsky, and T.S. Ratiu [2003], Variational principles for Lie-Poisson and Hamilton-Poincaré equations, *Moscow Mathematics Journal*, **3**, 833–867.
- Cendra, H., J.E. Marsden, and T.S. Ratiu [2001a], *Lagrangian Reduction by Stages*, Memoirs of the American Mathematical Society, volume 152, number 722. Providence, R.I.
- Cendra, H., J.E. Marsden, and T.S. Ratiu [2001b], Geometric mechanics, Lagrangian reduction and nonholonomic systems. In Engquist, B. and W. Schmid, editors, *Mathematics Unlimited-2001 and Beyond*, pages 221–273. Springer-Verlag, New York.
- Cendra, H., J.E. Marsden, and T.S. Ratiu [2003], Cocycles, compatibility, and Poisson brackets for complex fluids. In Capriz, G. and P. Mariano, editors, *Advances in Multifield Theories with Substructures*, Birkhäuser, Boston.
- Chang, D., A.M. Bloch, N. Leonard, J.E. Marsden, and C. Woolsey [2002], The equivalence of controlled Lagrangian and controlled Hamiltonian systems, *Control and the Calculus of Variations (special issue dedicated to J.L. Lions)*, **8**, 393–422.
- Chang, D.E., D.F. Chichka, and J.E. Marsden [2002], Lyapunov-based transfer between elliptic Keplerian orbits, *Discrete and Continuous Dynamical Systems: Series B*, **2**, 57–67.
- Charlier, C.L. [1927], *Die Mechanik des Himmels. Bd.I, II*, 2nd Edition, Walter de Gruyter, Berlin.

- Chern, S.J. and J.E. Marsden [1990], A note on symmetry and stability for fluid flows, *Geo. Astro. Fluid. Dyn.*, **51**, 1–4.
- Chernoff, P.R. and J.E. Marsden [1974], *Properties of Infinite Dimensional Hamiltonian systems*, Lecture Notes in Math., **425**. Springer, New York.
- Chetayev, N.G. [1941], On the equations of Poincaré, *J. Appl. Math. Mech.*, **5**, 253–262.
- Chobotov, V.A., ed. [1996], *Orbital Mechanics*, 2nd ed., in the AIAA Education Series, American Institute of Aeronautics and Astronautics, Inc., New York.
- Chossat, P., D. Lewis, J.-P. Ortega, and T.S. Ratiu [2003], Bifurcation of relative equilibria in mechanical systems with symmetry, *Adv. in Appl. Math.*, **31**, 10–45.
- Chossat, P., J.-P. Ortega, and T.S. Ratiu [2002], Hamiltonian Hopf bifurcation with symmetry, *Arch. Rational Mech. Anal.*, **163**, 1–33; **167**, 83–84.
- Coffey, S.L., A. Depit, and B.R. Miller [1986], The Critical Inclination in Artificial Satellite Theory, *Celestial Mechanics*, **39**, 365 – 406.
- Condevaux, M.P., P. Dazord, and P. Molino [1988], Géométrie du moment, *Travaux du Séminaire Sud-Rhodanien de Géométrie, I*, Publ. Dép. Math. Nouvelle Sér. B, 88-1, Univ. Claude-Bernard, Lyon, 131–160.
- Cortés, J., M. de León, J.C. Marrero, D. Martín de Diego, and E. Martínez [2006], A survey of Lagrangian mechanics and control on Lie algebroids and groupoids, *Int. J. Geom. Methods Mod. Phys.*, **3**, 509–558.
- Cushman, R.H. [1991], A Survey of Normalization Techniques applied to Perturbed Keplerian Systems, in K. Jones et al. *Dynamics Reported*, **1**, Springer-Verlag, New York.
- Cushman, R.H. and L.M. Bates [1997], *Global Aspects of Classical Integrable Systems*, Birkhäuser, Boston.
- Cushman, R.H. and D. Rod [1982], Reduction of the semi-simple 1:1 resonance, *Physica D*, **6**, 105–112.
- Cushman, R.H., D. Kemppainen, and J. Śniatycki [1998], A classical particle with spin realized by reduction of a nonlinear nonholonomic constraint, *Rep. Math. Phys.*, **41**, 133–142.
- Cushman, R.H. and J. Śniatycki [1999], Hamiltonian mechanics on principal bundles, *C. R. Math. Acad. Sci. Soc. R. Can.*, **22**, 60–64.
- Cushman, R.H. and Śniatycki, J. [2001], Differential structure of orbit spaces, *Canad. J. Math.*, **53**, 715–755, erratum **55**, (2003), 247.
- Cushman, R.H. and J. Śniatycki [2002], Nonholonomic reduction for free and proper actions, *Regul. Chaotic Dyn.*, **7**, 61–72.

- Dai, J. [2000], *Conjugacy Classes, Characters and Coadjoint Orbits of $Diff^+(S^1)$* , Ph.D. Thesis, University of Arizona.
- Dai, J. and D. Pickrell [2003], The orbit method and the Virasoro extension of $Diff^+(S^1)$, I. Orbital integrals *J. Geom. and Phys.*, **44**, 623–653.
- Dazord, P. [1985], Feuilletages à singularités, *Nederl. Akad. Wetensch. Indag. Math.*, **47**, 21–39.
- de Azcárraga, J.A. and J.M. Izquierdo [1995], *Lie Groups, Lie Algebras, Cohomology and Some Applications in Physics*, Cambridge Monographs on Mathematical Physics, Cambridge University Press.
- Delaunay, C. [1860], *Théorie du Mouvement de la Lune*, Mem. **28** (1860); **29** (1867), *Acad. Sci. France*, Paris.
- Deprit, A. [1983], Elimination of the nodes in problems of N bodies, *Celestial Mech.*, **30**, 181–195.
- Derks, G., D.K. Lewis, and T.S. Ratiu [1995], Approximations with curves of relative equilibria in Hamiltonian systems with dissipation, *Nonlinearity*, **8**, 1087–1113.
- Dirac, P.A.M. [1930], *The Principles of Quantum Mechanics*. Oxford University Press.
- Dirac, P.A.M. [1950], Generalized Hamiltonian mechanics, *Canad. J. Math.*, **2**, 129–148.
- Dirac, P.A.M. [1964], *Lectures on Quantum Mechanics*, Belfer Graduate School of Science, Monograph Series, volume 2. Yeshiva University.
- Duistermaat, J.J. [1980], On global action angle coordinates, *Comm. Pure Appl. Math.*, **33**, 687–706.
- Duistermaat, J.J. and J.A.C. Kolk [1999], *Lie Groups*. Springer Verlag.
- Duval, C., J. Elhadad, M.J. Gotay, J. Śniatycki, and G. M. Tuynman [1991], Quantization and bosonic BRST theory, *Ann. Phys.* **206**, 1–26.
- Duval, C., J. Elhadad, M.J. Gotay, and G.M. Tuynman [1992], Pukanszky’s condition and symplectic induction, *J. Diff. Geom.* **36**, 331–348.
- Eardley, D.M. and V. Moncrief [1982], The global existence of Yang-Mills-Higgs fields in 4-dimensional Minkowski space, *Comm. Math. Phys.*, **83**, 171–212.
- Ebin, D.G. and J.E. Marsden [1970], Groups of diffeomorphisms and the motion of an incompressible fluid, *Ann. of Math.*, **92**, 102–163.
- Emmrich, C. and H. Römer [1990], Orbifolds as configuration spaces of systems with g symmetries, *Comm. Math. Phys.*, **129**, 69–94.
- Feynman, R.P. and A.R. Hibbs [1965], *Quantum Mechanics and Path Integrals*, McGraw-Hill.

- Fischer, A.E., J.E. Marsden, and V. Moncrief [1980], The structure of the space of solutions of Einstein's equations, I: One Killing field, *Ann. Ins. H. Poincaré*, **33**, 147–194.
- Flato, M., A. Lichnerowicz, and D. Sternheimer [1976], Deformations of Poisson brackets, Dirac brackets and applications, *J. Mathematical Phys.*, **17**, 1754–1762.
- Fomenko, A.T. and V.V. Trofimov [1989], *Integrable Systems on Lie Algebras and Symmetric Spaces*, Gordon and Breach.
- Gardiner, F.P. and D.P. Sullivan [1992], Symmetric structures on a closed curve, *Amer. J. Math.*, **114**, 683–736.
- Gay-Balmaz, F. [2007], PhD Thesis, École Polytechnique Fédérale de de Lausanne.
- Gay-Balmaz, F. and T.S. Ratiu [2006], Group actions on chains of Banach manifolds and application to fluid dynamics, *Ann. Global Analysis Geom.*, to appear.
- Gay-Balmaz, F. and T.S. Ratiu [2007], Reduced Lagrangian and Hamiltonian formulations of Euler-Yang-Mills fluids, preprint.
- Gay-Balmaz, F., T.S. Ratiu, and J.E. Marsden [2007], The geometry of Teichmüller space and the Euler-Weil-Petersson equations, in preparation.
- Gelfand I. and D. Fuchs [1968], Cohomologies of the Lie algebra of vector fields on the circle. *Funkc. Anal. Prilozh.*, **2**, 92–93.
- Goldman, W.M. [1984], The symplectic nature of fundamental groups of surfaces. *Adv. in Math.*, **54**, 200–225.
- Goldman, W.M. and J.J. Millson [1990], Differential graded Lie algebras and singularities of level sets of momentum mappings, *Comm. Math. Phys.*, **131**, 495–515.
- Goldstein, H. [1980], *Classical Mechanics*, 2nd Edition, Addison-Wesley, Reading, Mass.
- Golubitsky, M., I. Stewart, and D. Schaeffer [1988], *Singularities and Groups in Bifurcation Theory*. Vol. II, Applied Mathematical Sciences, volume 69, Springer-Verlag, New York.
- Gotay, M., J. Isenberg, and J.E. Marsden [1997], Momentum Maps and the Hamiltonian Structure of Classical Relativistic Field Theories I, II, Available from <http://www.cds.caltech.edu/~marsden/>.
- Grabsi, F., J. Montaldi, and J.-P. Ortega [2004], Bifurcation and forced symmetry breaking in Hamiltonian systems, *C. R. Acad. Sci. Paris Sér. I Math.*, **338**, 565–570.
- Guichardet, A. [1984], On rotation and vibration motions of molecules, *Ann. Inst. H. Poincaré*, **40**, 329–342.

- Guieu, L. [2000], Stabilisateurs cycliques pour la représentation coadjointe du groupe des difféomorphismes du cercle, *Bull. Sci. Math.*, **124**, 125–145.
- Guieu, L. and C. Roger [2003], *L'Algèbre et le Groupe de Virasoro: Aspects Géométriques et Algébriques, Généralisations*, preprint.
- Guillemin, V. and S. Sternberg [1978], On the equations of motions of a classic particle in a Yang–Mills field and the principle of general covariance, *Hadronic J.*, **1**, 1–32.
- Guillemin, V. and S. Sternberg [1980], The moment map and collective motion, *Ann. of Phys.*, **1278**, 220–253.
- Guillemin, V. and S. Sternberg [1982a], Convexity properties of the moment map, *Invent. Math.*, **67**, 491–513; also **77**, 533–546.
- Guillemin, V. and S. Sternberg [1982b], Geometric quantization and multiplicities of group representations, *Invent. Math.*, **67**, 515–538.
- Guillemin, V. and S. Sternberg [1983], The Frobenius reciprocity theorem from a symplectic point of view, *Nonlinear Partial Differential Operators and Quantization Procedures (Clausthal, 1981)*, 242–256, Lecture Notes in Math., volume 1037, Springer-Verlag.
- Guillemin, V. and S. Sternberg [1984], *Symplectic Techniques in Physics*, Cambridge University Press.
- Hamel, G. [1904], Die Lagrange–Eulerschen Gleichungen der Mechanik, *Z. für Mathematik u. Physik*, **50**, 1–57.
- Hamel, G. [1949], *Theoretische Mechanik*, Springer-Verlag, Berlin.
- Hernandez, A. and J.E. Marsden [2005], Regularization of the amended potential and the bifurcation of relative equilibria, *J. of Nonlinear Sci.*, **15**, 93–132.
- Hochgerner, S. [2007] Singular cotangent bundle reduction and spin Calogero–Moser systems, *Diff. Geom. Appl.*, to appear.
- Holm, D.D. [2002], Euler–Poincaré dynamics of perfect complex fluids, in *Geometry, Dynamics, and Mechanics: 60th Birthday Volume for J.E. Marsden*. P. Holmes, P. Newton, and A. Weinstein, eds., Springer-Verlag.
- Holm, D.D. and B.A. Kupershmidt [1982], Poisson structures of superfluids, *Phys. Lett. A*, **91**, 425–430.
- Holm, D.D. and B.A. Kupershmidt [1983a], Poisson brackets and Clebsch representations for magnetohydrodynamics, multifluid plasmas and elasticity, *Physica D*, **6**, 347–363.
- Holm, D.D. and B.A. Kupershmidt [1983b], Poisson structures and superconductors, *Phys. Lett. A*, **93**, 177–181.
- Holm, D.D. and B.A. Kupershmidt [1988], The analogy between spin glasses and Yang–Mills fluids, *J. Math. Phys.*, **29**, 21–30.

- Holm, D.D., J.E. Marsden, and T.S. Ratiu [1986], The Hamiltonian structure of continuum mechanics in material, spatial and convective representations, in *Séminaire de Mathématiques supérieures*, **100**, 11–122, Les Presses de L’Univ. de Montréal, Montréal.
- Holm, D.D., J.E. Marsden, and T.S. Ratiu [1998], The Euler–Poincaré equations and semidirect products with applications to continuum theories, *Adv. in Math.*, **137**, 1–8.
- Holm, D.D., J.E. Marsden, and T.S. Ratiu [2002], The Euler–Poincaré equations in geophysical fluid dynamics. In Norbury, J. and I. Roulstone, editors, *Large-Scale Atmosphere-Ocean Dynamics II: Geometric Methods and Models*, pages 251–300. Cambridge Univ. Press.
- Holm, D.D., J.E. Marsden, T.S. Ratiu, and A. Weinstein [1985], Nonlinear stability of fluid and plasma equilibria, *Phys. Rep.* **123**, 1–6.
- Hopf, H. [1931], Über die Abbildungen der dreidimensionalen sphäre auf die Kugelfläche, *Math. Annalen*, **104**, 38–63.
- Huebschmann, J. [1998], Smooth structures on certain moduli spaces for bundles on a surface, *J. Pure Appl. Algebra* **126**, 183–221.
- Huebschmann, J. [2001], Singularities and Poisson geometry of certain representation spaces, in *Quantization of singular symplectic quotients*, *Progr. Math.*, volume 198, 119–135. Birkhäuser Boston, Boston, MA.
- Iglésias P. [1995], La trilogie du moment, *Ann. Inst. Fourier (Grenoble)*, **45**(3), 825–857.
- Ismagilov, R., M. Losik, and P. Michor [2006], A 2-cocycle on a group of symplectomorphisms, *preprint*.
- Iwai, T. [1982], The symmetry group of the harmonic oscillator and its reduction, *J. Math. Phys.*, **23**, 1088–1092.
- Iwai, T. [1985], On reduction of two degrees of freedom Hamiltonian systems by an S^1 action and $SO_0(1, 2)$ as a dynamical group, *J. Math. Phys.*, **26**, 885–893.
- Iwai, T. [1987], A geometric setting for classical molecular dynamics, *Ann. Inst. Henri Poincaré, Phys. Th.*, **47**, 199–219.
- Iwai, T. [1990], On the Guichardet/Berry connection, *Phys. Lett. A* **149**, 341–344.
- Jacobi, C.G.K. [1843], *J. für Math.*, **26**, 115.
- Jacobi, C.G.K. [1866], *Vorlesungen über Dynamik*. Verlag G. Reimer. Based on lectures given in 1842–3, Reprinted by Chelsea, 1969.
- Jalnapurkar, S.M. and J.E. Marsden [2000], Reduction of Hamilton’s variational principle, *Dynam. Stability Systems*, **15**, 287–318.
- Jalnapurkar, S.M., M. Leok, J.E. Marsden and M. West [2006], Discrete Routh reduction, *J. Phys. A: Math. Gen.*, **39**, 5521–5544.

- Kane, C., J.E. Marsden, M. Ortiz, and M. West [2000], Variational integrators and the Newmark algorithm for conservative and dissipative mechanical systems, *Int. J. Num. Math. Eng.*, **49**, 1295–1325.
- Kanso, E., J.E. Marsden, C.W. Rowley, and J. Melli-Huber [2005], Locomotion of articulated bodies in a perfect fluid, *J. Nonlinear Science*, **15**, 255–289.
- Kappeler, T. and J. Pöschel [2003], *KdV & KAM*, Ergebnisse der Mathematik und ihrer Grenzgebiete. 3. Folge, volume 45. Springer-Verlag, Berlin.
- Karapetyan, A.V. [2000], On construction of the effective potential in singular cases, *Regul. Chaotic Dyn.*, **5**, 219–224.
- Kato, T. [1983], On the Cauchy problem for the (generalized) Korteweg-de Vries equation, in *Studies in applied mathematics*, volume 8 of *Adv. Math. Suppl. Stud.*, pages 93–128. Academic Press, New York.
- Kato, T. [1991], Weak solutions of infinite-dimensional Hamiltonian systems, in *Frontiers in Pure and Applied Mathematics*, North Holland, 133–149.
- Kazhdan, D., B. Kostant, and S. Sternberg [1978], Hamiltonian group actions and dynamical systems of Calogero type, *Comm. Pure Appl. Math.*, **31**, 481–508.
- Khesin, B. and G. Misiolek [2003], Euler equations on homogeneous spaces and Virasoro orbits, *Adv. Math.*, **176**, 116–144.
- Kijowski, J. and W. Tulczyjew [1979], *A Symplectic Framework for Field Theories*, Springer Lect. Notes in Physics, volume 107.
- Kirillov, A.A. [1962], Unitary representations of nilpotent Lie groups, *Russian Math. Surveys*, **17**, 53–104.
- Kirillov, A.A. [1976a], *Elements of the Theory of Representations*, Grundlehren der Math. Wiss., volume 220, Springer-Verlag.
- Kirillov, A.A. [1976b], Local Lie Algebras, *Russian Math. Surveys* **31**, 55–75.
- Kirillov, A.A. [1982], Infinite dimensional Lie groups; their orbits, invariants and representations. The geometry of moments, in *Lecture Notes in Mathematics*, **970**, 101–123.
- Kirk, V., J.E. Marsden, and M. Silber [1996], Branches of stable three-tori using Hamiltonian methods in Hopf bifurcation on a rhombic lattice, *Dyn. and Stab. of Systems*, **11**, 267–302.
- Kirwan, F.C. [1984a], *Cohomology Quotients in Symplectic and Algebraic Geometry*, Princeton Math. Notes, volume 31. Princeton University Press.
- Kirwan, F.C. [1984b], Convexity properties of the moment map III, *Invent. Math.*, **77**, 547–552.
- Knapp, A.W. [2002], *Lie Groups Beyond an Introduction*, Second edition, *Progress in Mathematics*, volume **140**, Birkhäuser, Boston.

- Kobayashi, S. and K. Nomizu [1963], *Foundations of Differential Geometry*. Wiley
- Koiller, J. [1992], Reduction of some classical nonholonomic systems with symmetry, *Arch. Rational Mech. Anal.*, **118**, 113–148.
- Koon, W.S., M. Lo, J.E. Marsden, and S. Ross [2000], Heteroclinic Connections between periodic orbits and resonance transitions in celestial mechanics, *Chaos*, **10**, 427–469.
- Koon, W.S. and J.E. Marsden [1997], Optimal control for holonomic and nonholonomic mechanical systems with symmetry and Lagrangian reduction, *SIAM J. Control and Optim.*, **35**, 901–929.
- Koon, W.S. and J.E. Marsden [1998], The Poisson reduction of nonholonomic mechanical systems, *Reports on Math. Phys.*, **42**, 101–134.
- Kostant, B. [1966], Orbits, symplectic structures and representation theory, in *Proc. US-Japan Seminar on Diff. Geom. (Kyoto)*, Nippon Hyronsha, Tokyo., **77**.
- Kostant, B. [1970], Quantization and unitary representations, in *Springer Lect. Notes in Math.*, **570**, 177–306.
- Kovalevsky, J. [1967], *Introduction to Celestial Mechanics*, Springer-Verlag, New York.
- Kriegl, A. and P.W. Michor [1997], *The Convenient Setting of Global Analysis*, Mathematical Surveys and Monographs, volume 53, American Mathematical Society, Providence, RI.
- Krishnaprasad, P.S. [1990], Geometric phases and optimal reconfiguration for multibody systems, in *Proc. Am. Control Conf.*, pages 2440–2444.
- Krishnaprasad, P.S. and J.E. Marsden [1987], Hamiltonian structure and stability for rigid bodies with flexible attachments, *Arch. Rational Mech. Anal.*, **98**, 137–158.
- Krishnaprasad, P.S., J.E. Marsden, and T. Posbergh [1987], Stability analysis of a rigid body with a flexible attachment using the enregy-Casimir method, *Contemp. Math., Amer. Math. Soc.*, **68**, 253–273.
- Krishnaprasad, P.S., R. Yang, and W.P. Dayawansa [1993], Chaplygin dynamics and Lagrangian reduction, in *Proc. 2nd Int. Cong. on Nonlinear Mechanics*, W-Z. Chien, Z.H. Guo & Y.Z. Guo, eds., 745–749. Peking University Press.
- Krupa, M., M. Schagerl, A. Steindl, P. Szmolyan, and H. Troger [2001], Relative equilibria of tethered satellite systems and their stability for very stiff tethers, *Dynamical Systems: An Int. J.*, **16**, 253–278.
- Kummer, M. [1981], On the construction of the reduced phase space of a Hamiltonian system with symmetry, *Indiana Univ. Math. J.*, **30**, 281–291.
- Kummer, M. [1990], On resonant classical Hamiltonians with n frequencies, *J. Diff. Eqns.*, **83**, 220–243.

- Lagrange, J.L. [1788], *Mécanique Analytique*, Chez la Veuve Desaint, Paris.
- Landsman, N.P. [1995], Rieffel induction as generalized quantum Marsden-Weinstein reduction, *J. Geom. Phys.*, **15**, 285–319. (Erratum: *J. Geom. Phys.*, **17**, 298).
- Landsman, N.P. [1998], *Mathematical Topics Between Classical and Quantum Mechanics*, Springer Monographs in Mathematics, Springer-Verlag, New York.
- Lazutkin, V. and T. Pankratova [1975], Normal forms and versal deformations for Hill's equation, *Funkc. Anal. Prilozh.*, **9**, 41–48.
- Lehto, O. [1987], *Univalent Functions and Teichmüller Spaces*, Graduate Texts in Mathematics, **109**, Springer-Verlag.
- Leonard, N.E. and J.E. Marsden [1997], Stability and drift of underwater vehicle dynamics: mechanical systems with rigid motion symmetry, *Physica D*, **105**, 130–162.
- Lerman, E., Montgomery, R., and Sjamaar, R. [1993] Examples of singular reduction, in *Symplectic Geometry*, 127–155, London Math. Soc. Lecture Note Ser., **192**, Cambridge Univ. Press, Cambridge.
- Lerman, E. and S.F. Singer [1998], Stability and persistence of relative equilibria at singular values of the moment map, *Nonlinearity*, **11**, 1637–1649.
- Lerman, E. and T.F. Tokieda [1999], On relative normal modes, *C. R. Acad. Sci. Paris Sér. I Math.*, **328**, 413–418.
- Lew, A., J.E. Marsden, M. Ortiz, and M. West [2004], Variational time integrators, *Internat. J. Numer. Methods Engrg.*, **60**, 153–212.
- Lewis, D. [1989], Nonlinear stability of a rotating planar liquid drop, *Arch. Rational Mech. Anal.*, **106**, 287–333.
- Lewis, D. [1992a], Lagrangian block diagonalization, *Dyn. Diff. Eqn's*, **4**, 1–42.
- Lewis, D. [1992b], Bifurcation of liquid drops, *Nonlinearity*, **6**, 491–522.
- Lewis, D. [1994], Quasi-periodic motions of planar liquid drops, *Contemp. Math.*, **170**, 185–199.
- Lewis, D. [1995], Linearized dynamics of symmetric Lagrangian systems. In *Hamiltonian dynamical systems*, IMA Math. Appl., **63**, 195–216. Springer-Verlag, New York.
- Lewis, D., J.E. Marsden, R. Montgomery, and T.S. Ratiu [1986], The Hamiltonian structure for dynamic free boundary problems, *Physica D*, **18**, 391–404.
- Lewis, D., J.E. Marsden, and T. Ratiu [1986], Formal stability of liquid drops with surface tension. In Shlesinger, M. F., R. Cawley, A. W. Saenz, and W. Zachary, editors, *Perspectives in Nonlinear Dynamics*, pages 71–83. World Scientific.

- Lewis, D., J.E. Marsden, and T.S. Ratiu [1987], Stability and bifurcation of a rotating liquid drop, *J. Math. Phys.*, **28**, 2508–2515.
- Lewis, D., J.E. Marsden, T.S. Ratiu, and J.C. Simo [1990], Normalizing connections and the energy–momentum method, in *Proceedings of the CRM conference on Hamiltonian systems, Transformation Groups and Spectral Transform Methods*, Harnad and Marsden, eds., , 207–227, CRM Press.
- Lewis, D., T.S. Ratiu, J.C. Simo, and J.E. Marsden [1992], The heavy top: a geometric treatment, *Nonlinearity*, **5**, 1–48.
- Lewis, D. and J.C. Simo [1990], Nonlinear stability of rotating pseudo-rigid bodies, *Proc. Roy. Soc. Lon. A*, **427**, 281–319.
- Liebermann, P. and C.-M. Marle [1987], *Symplectic Geometry and Analytical Mechanics*, Kluwer Academic Publishers.
- Lichnerowicz, A. [1977], Les variétés de Poisson et leurs algèbres de Lie associées, *J. Diff. Geom.*, **12**, 253–300.
- Lie, S. [1890], *Theorie der Transformationsgruppen*, Volumes I-III, Teubner, Leipzig, reprinted by Chelsea (AMS).
- Littlejohn, R. and M. Reinch [1997], Gauge fields in the separation of rotations and internal motions in the n -body problem, *Rev. Mod. Phys.* **69**, 213–275.
- Mackey, G. [1968] *Induced Representations of Groups and Quantum Mechanics*, W.A. Benjamin, Inc.
- Maier, P. and Neeb, K.-H. [2003], Central extensions of current groups, *Math. Ann.*, **326**, 367–415.
- Marle, C.-M. [1976], Symplectic manifolds, dynamical groups and Hamiltonian mechanics. In *Differential Geometry and Relativity*. M. Cahen, and M. Flato (eds.). Reidel.
- Marsden, J.E. [1976], Well-posedness of the equations of a nonhomogeneous perfect fluid, *Comm. Partial Differential Equations*, **1**, 215–230.
- Marsden, J.E. [1981], *Lectures on Geometric Methods in Mathematical Physics*, CBMS series, SIAM, Philadelphia, PA.
- Marsden, J.E. [1982], A group theoretic approach to the equations of plasma physics, *Can. Math. Bull.*, **25**, 129–142.
- Marsden, J.E. [1992], *Lectures on Mechanics*, London Math. Soc. Lecture Note Ser., volume 174, Cambridge University Press.
- Marsden, J.E. [1999], Park City lectures on mechanics, dynamics and symmetry, in Eliashberg, Y. and L. Traynor, editors, *Symplectic Geometry and Topology, IAS/Park City Math. Ser.*, **7**, 335–430, Amer. Math. Soc., Providence, RI.
- Marsden, J.E. and T.J.R. Hughes [1983], *Mathematical Foundations of Elasticity*, Prentice Hall, reprinted by Dover Publications, NY, 1994.

- Marsden, J., G. Misiolek, M. Perlmutter, and T.S. Ratiu [1998], Symplectic reduction for semidirect products and central extensions, *Diff. Geom. and its Appl.*, **9**, 173–212.
- Marsden, J.E., R. Montgomery, P.J. Morrison, and W.B. Thompson [1986], Covariant Poisson brackets for classical fields, *Annals of Physics*, **169**, 29–48.
- Marsden, J.E., R. Montgomery, and T.S. Ratiu [1990], *Reduction, Symmetry and Phases in Mechanics*, Memoirs Amer. Math. Soc., **436**.
- Marsden, J.E., P.J. Morrison, and A. Weinstein [1984], The Hamiltonian structure of the BBGKY hierarchy equations, *Contemp. Math.* **28**, 115–124.
- Marsden, J.E. and J. Ostrowski [1996], Symmetries in motion: Geometric foundations of motion control, *Nonlinear Sci. Today.* (<http://link.springer-ny.com>).
- Marsden, J.E., G.W. Patrick, and W.F. Shadwick (Eds.) [1996], *Integration Algorithms and Classical Mechanics*, Fields Inst. Commun., **10**, Amer. Math. Soc.
- Marsden, J.E., G.W. Patrick, and S. Shkoller [1998], Multisymplectic geometry, variational integrators and nonlinear PDEs, *Comm. Math. Phys.*, **199**, 351–395.
- Marsden, J.E., S. Pekarsky, and S. Shkoller [1999], Discrete Euler–Poincaré and Lie–Poisson equations, *Nonlinearity*, **12**, 1647–1662.
- Marsden, J.E. and M. Perlmutter [2000], The orbit bundle picture of cotangent bundle reduction, *C. R. Math. Acad. Sci. Soc. R. Can.*, **22**, 33–54.
- Marsden, J. E. and T.S. Ratiu [1986], Reduction of Poisson manifolds, *Lett. in Math. Phys.*, **11**, 161–170.
- Marsden, J.E. and T.S. Ratiu [1999], *Introduction to Mechanics and Symmetry*, Texts in Applied Mathematics, **17**, Springer-Verlag, 1994; Second Edition, 1999, reprinted with corrections, 2003.
- Marsden, J.E., T.S. Ratiu, and J. Scheurle [2000], Reduction theory and the Lagrange-Routh equations, Amer. Inst. Phys., Melville, NY, *J. Math. Phys.*, **41**, 3379–3429.
- Marsden, J.E., T.S. Ratiu, and A. Weinstein [1984a], Semidirect products and reduction in mechanics, *Trans. Amer. Math. Soc.*, **281**, 147–177.
- Marsden, J.E., T.S. Ratiu, and A. Weinstein [1984b], Reduction and Hamiltonian structures on duals of semidirect product Lie Algebras, *Contemp. Math., Am. Math. Soc.*, **28**, 55–100.
- Marsden, J.E. and J. Scheurle [1993a], Lagrangian reduction and the double spherical pendulum, *ZAMP*, **44**, 17–43.
- Marsden, J.E. and J. Scheurle [1993b], The reduced Euler–Lagrange equations, *Fields Inst. Comm.*, **1**, 139–164.

- Marsden, J.E. and S. Shkoller [1999], Multisymplectic geometry, covariant Hamiltonians and water waves, *Math. Proc. Camb. Phil. Soc.*, **125**, 553–575.
- Marsden, J.E. and J.C. Simo [1990], The energy–momentum method, *La “Mécanique Analytique” de Lagrange et son Héritage*, Atti della Accademia delle Scienze di Torino, **124**, 245–268.
- Marsden, J.E., J.C. Simo, D.K. Lewis, and T.A. Posbergh [1989], A block diagonalization theorem in the energy–momentum method, *Contemp. Math.* **97**, 297–313.
- Marsden, J.E. and A. Weinstein [1974], Reduction of symplectic manifolds with symmetry, *Rep. Math. Phys.*, **5**, 121–130.
- Marsden, J. E. and A. Weinstein [1982], The Hamiltonian structure of the Maxwell–Vlasov equations, *Physica D*, **4**, 394–406.
- Marsden, J.E. and A. Weinstein [1983], Coadjoint orbits, vortices and Clebsch variables for incompressible fluids, *Physica D*, **7**, 305–323.
- Marsden, J.E. and A. Weinstein [2001], Comments on the history, theory, and applications of symplectic reduction. In Landsman, N., M. Pflaum, and M. Schlichenmaier, editors, *Quantization of Singular Symplectic Quotients*. Progress in Mathematics, volume 198. Birkhäuser Boston, pp 1–20.
- Marsden, J.E., A. Weinstein, T.S. Ratiu, R. Schmid and R.G. Spencer [1982], Hamiltonian systems with symmetry, coadjoint orbits and plasma physics, in *Proc. IUTAM-IS1MM Symposium on Modern Developments in Analytical Mechanics (Torino, 1982)*, **117**, 289–340, Atti della Acad. della Sc. di Torino.
- Marsden, J.E. and M. West [2001], Discrete mechanics and variational integrators, *Acta Numerica*, **10**, 357–514.
- Martin, J.L. [1959], Generalized classical dynamics and the “classical analogue” of a Fermi oscillation, *Proc. Roy. Soc. A*, **251**, 536–542.
- McDuff, D. [1988], The moment map for circle actions on symplectic manifolds, *J. Geom. Phys.*, **5**, 149–160.
- McDuff, D. and D. Salamon [1995], *Introduction to Symplectic Topology*, Oxford University Press.
- Mestdag, T. [2005], Lagrangian reduction by stages for non-holonomic systems in a Lie algebroid framework, *J. Phys. A*, **38**, 10157–10179.
- Meyer, K.R. [1973], Symmetries and integrals in mechanics, in *Dynamical Systems*, M. Peixoto, ed., 259–273, Academic Press.
- Mielke, A. [1991], *Hamiltonian and Lagrangian Flows on Center Manifolds, with Applications to Elliptic Variational Problems*, Springer Lect. Notes in Math., **1489**.
- Mielke, A. [2002a], On the energetic stability of solitary water waves, *Phil. Trans. Roy. Soc. A.*, **360**, 2337–2358.

- Mielke, A. [2002b], Finite elastoplasticity Lie groups and geodesics on $SL(d)$, in *Geometry, mechanics, and dynamics*, 61–90, Springer, New York.
- Mikami, K. and A. Weinstein [1988], Moments and reduction for symplectic groupoid actions, *Publ. RIMS Kyoto Univ.*, **24**, 121–140.
- Mishchenko, A.S. and A.T. Fomenko [1978], Generalized Liouville method of integration of Hamiltonian systems, *Funct. Anal. Appl.*, **12**, 113–121.
- Misiołek, G. [1997], Conjugate points in the Bott–Virasoro group and the KdV equation, *Proc. Amer. Math. Soc.*, **125**, 935–940.
- Misiołek, G. [1998], A shallow water equation as a geodesic flow on the Bott–Virasoro group, *J. Geom. Phys.*, **24**, 203–208.
- Misner, C., K. Thorne, and J.A. Wheeler [1973], *Gravitation*, W. H. Freeman, San Francisco.
- Mittagunta, G.G. [1994] *Reduced Spaces for Coupled Rigid Bodies and their Relation to Relative Equilibria*, Ph.D. Thesis, University of California, Santa Cruz, 1994.
- Mittagunta, G.G. [1996], Reduced spaces for coupled rigid bodies, *J. Nonlinear Sci.*, **6**, 293–310.
- Montaldi, J. [1997], Persistence and stability of relative equilibria, *Nonlinearity*, **10**, 449–466.
- Montaldi, J.A., R.M. Roberts, and I.N. Stewart [1988], Periodic solutions near equilibria of symmetric Hamiltonian systems, *Phil. Trans. R. Soc. Lond. A*, **325**, 237–293.
- R. Montgomery [1983], The structure of reduced cotangent phase spaces for non-free group actions, preprint **143** of the U.C. Berkeley Center for Pure and App. Mathematics.
- Montgomery, R. [1984], Canonical formulations of a particle in a Yang–Mills field, *Lett. Math. Phys.*, **8**, 59–67.
- Montgomery, R. [1986], *The Bundle Picture in Mechanics*, Ph.D. Thesis, University of California, Berkeley.
- Montgomery, R. [1988], The connection whose holonomy is the classical adiabatic angles of Hannay and Berry and its generalization to the nonintegrable case, *Comm. Math. Phys.*, **120**, 269–294.
- Montgomery, R. [1990], Isoholonomic problems and some applications, *Comm. Math. Phys.*, **128**, 565–592.
- Montgomery, R. [1991a], Optimal control of deformable bodies and its relation to gauge theory, in *The Geometry of Hamiltonian Systems*, T. Ratiu, ed., Springer-Verlag.

- Montgomery, R. [1991b], How much does a rigid body rotate? A Berry's phase from the 18th century, *Amer. J. Phys.*, **59**, 394–398.
- Montgomery, R. [1993], Gauge theory of the falling cat, *Fields Inst. Commun.*, **1**, 193–218.
- Montgomery, R. [1995], The geometric phase for the three body problem, *Nonlinearity*, **9**, 1341–1360.
- Montgomery, R., J.E. Marsden, and T.S. Ratiu [1984], Gauged Lie–Poisson structures, *Contemp. Math., Amer. Math. Soc.*, **28**, 101–114.
- Morrison, P.J. [1987], Variational principle and stability of nonmonotone Vlasov–Poisson equilibria, *Z. Naturforsch.*, **42a**, 1115–1123.
- Morrison, P.J. and J.M. Greene [1980], Noncanonical Hamiltonian density formulation of hydrodynamics and ideal magnetohydrodynamics, *Phys. Rev. Lett.*, **45**, 790–794; errata **48** (1982), 569.
- Moser, J. [1958], New aspects in the theory of stability of Hamiltonian systems, *Comm. Pure Appl. Math.*, **XI**, 81–114.
- Moser, J. [1965], On the volume elements on a manifold, *Trans. Am. Math. Soc.*, **120**, 286–294.
- Moser, J. [1970], Regularization of Kepler's problem and the averaging method on a manifold, *Comm. Pure Appl. Math.*, **23**, 609–636.
- Moser, J. [1973], *Stable and Random Motions in Dynamical Systems with Special Emphasis on Celestial Mechanics*, Princeton University Press.
- Moser, J. [1976], Periodic orbits near an equilibrium and a theorem by Alan Weinstein, *Comm. Pure Appl. Math.*, **29**, 724–747.
- Naber, G.L. [1997], *Topology, Geometry, and Gauge Fields: Foundations*, Springer-Verlag, New York.
- Nag, S. and A. Verjovsky [1990], $\text{Diff}(S^1)$ and the Teichmüller spaces, *Comm. Math. Phys.*, **130**, 123–138.
- Nambu, Y. [1973], Generalized Hamiltonian dynamics, *Phys. Rev. D*, **7**, 2405–2412.
- Neeb, K.-H. [2002], Central extensions of infinite-dimensional Lie groups, *Ann. Inst. Fourier (Grenoble)*, **52**(5), 1365–1442.
- Neeb, K.-H. [2004a], Abelian extensions of infinite-dimensional Lie groups, preprint.
- Neeb, K.-H. [2004b], Infinite-dimensional Groups and their Representations. In *Lie theory*, Progress in Mathematics **228**, 213–328. Birkhäuser Boston, Boston, MA.

- Nekhoroshev, N.M. [1971], Action angle variables and their generalizations, *Trans. Moscow Math. Soc.*, **26**, 180–198.
- Nill, F. [1983], An effective potential for classical Yang–Mills fields as outline for bifurcation on gauge orbit space, *Ann. Phys.*, **149**, 179–202.
- Oh, Y.G., N. Sreenath, P.S. Krishnaprasad, and J.E. Marsden [1989], The dynamics of coupled planar rigid bodies Part 2: bifurcations, periodic solutions and chaos, *Dynamics and Diff. Eq.*, **1**, 269–298.
- Ortega, J.-P. [1998], *Symmetry, Reduction, and Stability in Hamiltonian Systems*. Ph.D. Thesis. University of California, Santa Cruz. June, 1998.
- Ortega, J.-P. [2002], The symplectic reduced spaces of a Poisson action, *C. R. Acad. Sci. Paris Sér. I Math.*, **334**, 999–1004.
- Ortega, J.-P. [2003a], Singular dual pairs, *Differential Geom. Appl.*, **19**, 61–95.
- Ortega, J.-P. [2003b], Relative normal modes for nonlinear Hamiltonian systems, *Proc. Roy. Soc. Edinburgh Sect. A*, **133**, 665–704.
- Ortega, J.-P. and V. Planas-Bielsa [2004], Dynamics on Leibniz manifolds. *J. Geom. Phys.*, **52**(1), 1–27
- Ortega, J.-P. and T.S. Ratiu [1997], Persistence and smoothness of critical relative elements in Hamiltonian systems with symmetry, *C.R. Acad. Sci. Paris Sr. I Math.*, **325**, 1107–1111.
- Ortega, J.-P. and Ratiu, T.S. [1998], Singular reduction of Poisson manifolds. *Letters in Mathematical Physics*, **46**, 359–372.
- Ortega, J.-P. and T.S. Ratiu [1999a], Non-linear stability of singular relative periodic orbits in Hamiltonian systems with symmetry, *J. Geom. Phys.*, **32**, 160–188.
- Ortega, J.-P. and T.S. Ratiu [1999b], Stability of Hamiltonian relative equilibria, *Nonlinearity*, **12**(3), 693–720.
- Ortega, J.-P. and T.S. Ratiu [2001], A symplectic slice theorem. *Lett. Math. Phys.*, **59**, 81–93.
- Ortega, J.-P. and T.S. Ratiu [2002], The optimal momentum map, in *Geometry, Dynamics, and Mechanics: 60th Birthday Volume for J.E. Marsden*, pages 329–362. P. Holmes, P. Newton, and A. Weinstein, eds., Springer-Verlag.
- Ortega, J.-P. and T.S. Ratiu [2004a], *Momentum Maps and Hamiltonian Reduction*, volume 222 of Progress in Mathematics. Birkhäuser Boston Inc., Boston, MA.
- Ortega, J.-P. and T.S. Ratiu [2004b], Relative equilibria near stable and unstable Hamiltonian relative equilibria, *Proc. R. Soc. Lond. Ser. A*, **460**(2045), 1407–1431.

- Ortega, J.-P. and T.S. Ratiu [2006a], The reduced spaces of a symplectic Lie group action, *Annals of Global Analysis and Geometry*, **30**, 335–381.
- Ortega, J.-P. and T.S. Ratiu [2006b], The stratified spaces of a symplectic Lie group action, *Reports on Mathematical Physics*, **58**, 51–75.
- Otto, M. [1987], A reduction scheme for phase spaces with almost Kähler symmetry. Regularity results for momentum level sets, *J. Geom. Phys.*, **4**, 101–118.
- Ovsienko, V.Y. and B.A. Khesin [1987], Korteweg-de Vries superequations as an Euler equation, *Funct. Anal. and Appl.*, **21**, 329–331.
- Palais, R.S. [1957], *A Global Formulation of the Lie Theory of Transformation Groups*, Mem. Amer. Math. Soc., volume **22**.
- Palais, R.S. [1968], *Foundations of Global Non-Linear Analysis*, Benjamin/Cummins Publishing Co., Reading, MA.
- Paterson, A.L.T. [1999], *Groupoids, Inverse Semigroups, and their Operator Algebras*. Progress in Mathematics, volume 170. Birkhäuser.
- Patrick, G.W. [1989], The dynamics of two coupled rigid bodies in three space, *Contemp. Math.*, **97**, 315–336.
- Patrick, G.W. [1990], *Two Axially Symmetric Coupled Rigid Bodies: Relative Equilibria, Stability, Bifurcations, and a Momentum Preserving Symplectic Integrator*. Ph.D. Thesis, University of California, Berkeley.
- Patrick, G.W. [1992], Relative equilibria in Hamiltonian systems: The dynamic interpretation of nonlinear stability on a reduced phase space, *J. Geom. and Phys.*, **9**, 111–119.
- Patrick, G.W. [1995], Relative equilibria of Hamiltonian systems with symmetry: linearization, smoothness and drift, *J. Nonlinear Sci.*, **5**, 373–418.
- Patrick, G.W. [1999], The Landau-Lifshitz equation by semidirect product reduction, *Lett. Math. Phys.*, **50**, 177–188.
- Patrick, G.W., M. Roberts, and C. Wulff [2004], Stability of Poisson equilibria and Hamiltonian relative equilibria by energy methods, *Arch. Ration. Mech. Anal.*, **174**, 301–344.
- Pauli, W. [1953], On the Hamiltonian structure of nonlocal field theories, *Il Nuovo Cimento*, **X**, 648–667.
- Pedroni, M. [1995], Equivalence of the Drinfeld-Sokolov reduction to a bi-Hamiltonian reduction, *Lett. Math. Phys.*, **35**, 291–302.
- Perlmutter, M. [1999], *Symplectic Reduction by Stages*, Ph.D. Thesis, Mathematics, University of California, Berkeley.
- Perlmutter, M. and T.S. Ratiu [2005], Gauged Poisson structures, preprint.

- Perlmutter, M. and M. Rodríguez-Olmos [2006], On singular Sternberg spaces, in progress.
- Perlmutter, M., M. Rodríguez-Olmos, and M.E. Sousa Dias [2006], On the geometry of reduced cotangent bundles at zero momentum, *J. of Geom. and Phys.*, **57**, 571–596.
- Perlmutter, M., M. Rodríguez-Olmos, and M.E. Sousa Dias [2007], On the symplectic normal space for cotangent lifted actions, *Diff. Geom. Appl.*, to appear; see <http://front.math.ucdavis.edu/math.SG/0501207>.
- Pflaum, M.J. [2001], *Analytic and Geometric Study of Stratified Spaces*, volume 1768 of Lecture Notes in Mathematics, Springer–Verlag.
- Planas-Bielsa, V. [2004], Point reduction in almost symplectic manifolds, *Rep. Math. Phys.*, **54**, 295–308.
- Poincaré, H. [1885], Sur l'équilibre d'une masse fluide animée d'un mouvement de rotation, *Acta. Math.*, **7**, 259.
- Poincaré, H. [1890], Sur le problème des trois corps et les équations de la dynamique, *Acta Math.*, **13**, 1–27.
- Poincaré, H. [1901a], Sur une forme nouvelle des équations de la mécanique, *C.R. Acad. Sci.*, **132**, 369–371.
- Poincaré, H. [1901b], Sur la stabilité de l'équilibre des figures piriformes affectées par une masse fluide en rotation, *Philosophical Transactions A*, **198**, 333–373.
- Poincaré, H. [1910], Sur la precession des corps deformables, *Bull. Astron.*, **27**, 321–356.
- Pressley, A. and G. Segal [1986], *Loop Groups*, Oxford University Press.
- Ratiu, T.S. [1980a], *The Euler–Poisson Equations and Integrability*, Ph.D. Thesis, University of California, Berkeley.
- Ratiu, T.S. [1980b], The motion of the free n -dimensional rigid body, *Indiana Univ. Math. Journal*, **29**, 609–629.
- Ratiu, T.S. [1980c], Involution theorems, in *Geometric Methods in Mathematical Physics*, G. Kaiser and J. Marsden, eds., Springer Lecture Notes, **775**, 219–257.
- Ratiu, T.S. [1981], Euler-Poisson equations on Lie algebras and the N -dimensional heavy rigid body, *Proc. Natl. Acad. Sci., USA*, **78**, 1327–1328.
- Ratiu, T.S. [1982], Euler-Poisson equations on Lie algebras and the N -dimensional heavy rigid body, *Amer. J. Math.*, **104**, 409–448, 1337.
- Roberts, M. and M.E.R. de Sousa Dias [1997], Bifurcations from relative equilibria of Hamiltonian systems, *Nonlinearity*, **10**, 1719–1738.
- Roberts, M., C. Wulff, and J.S.W. Lamb [2002], Hamiltonian systems near relative equilibria, *J. Differential Equations*, **179**(2), 562–604.

- Rodríguez-Olmos, M. [2006a], The isotropy lattice of a lifted action, *C. R. Math. Acad. Sci. Paris. Ser. I*, **343**, 41–46.
- Rodríguez-Olmos, M. [2006b], Stability of relative equilibria with singular momentum values in simple mechanical systems, *Nonlinearity*, **19**, 853–877.
- Routh, E.J. [1860], *Treatise on the Dynamics of a System of Rigid Bodies*, MacMillan, London.
- Routh, E.J. [1877], *Stability of a Given State of Motion*, Halsted Press, New York; Reprinted in *Stability of Motion* (1975), A. T. Fuller ed.
- Routh, E.J. [1884], *Advanced Rigid Dynamics*, MacMillan and Co., London.
- Satake, I. [1956], On a generalization of the notion of manifold, *Proc. Nat. Acad. Sci. U.S.A.*, **42**, 359–363.
- Satzer, W.J. [1977], Canonical reduction of mechanical systems invariant under Abelian group actions with an application to celestial mechanics, *Ind. Univ. Math. J.*, **26**, 951–976.
- Schmah, T. [2002], *Symmetries of Cotangent Bundles*. Ph.D. thesis, École Polytechnique Fédérale de Lausanne, Switzerland
- Schonbek, M.E., Todorov, A.N., and Zubelli, J.P. [1999], Geodesic flows on diffeomorphisms of the circle, Grassmannians, and the geometry of the periodic KdV equation, *Adv. Theor. Math. Phys.*, **3**, 1027–1092.
- Segal, G. [1981], Unitary representations of some infinite-dimensional groups, *Comm. Math. Phys.*, **80**, 301–342.
- Simo, J.C., D.K. Lewis, and J.E. Marsden [1991], Stability of relative equilibria I: The reduced energy momentum method, *Arch. Rational Mech. Anal.*, **115**, 15–59.
- Simo, J., T.A. Posbergh, and J.E. Marsden [1989], Stability analysis of a rigid body with attached geometrically nonlinear rod by the energy-momentum method, *Contemp. Math., Amer. Math. Soc.*, **97**, 371–398.
- Simo, J.C., T.A. Posbergh, and J.E. Marsden [1990], Stability of coupled rigid body and geometrically exact rods: block diagonalization and the energy-momentum method, *Physics Reports*, **193**, 280–360.
- Simo, J.C., T.A. Posbergh, and J.E. Marsden [1991], Stability of relative equilibria II: Three dimensional elasticity, *Arch. Rational Mech. Anal.*, **115**, 61–100.
- Sjamaar, R. [1990], *Singular Orbit Spaces in Riemannian and Symplectic Geometry*, Ph.D. Thesis, Rijksuniversiteit te Utrecht.
- Sjamaar, R. and E. Lerman [1991], Stratified symplectic spaces and reduction, *Ann. of Math.*, **134**, 375–422.
- Smale, S. [1970], Topology and Mechanics, *Inv. Math.*, **10**, 305–331; **11**, 45–64.

- Śniatycki, J. [1974], Dirac brackets in geometric dynamics, *Ann. Inst. H. Poincaré*, **20**, 365–372.
- Śniatycki, J. [1999], A Hamiltonian analysis of Yang-Mills equations, *Rep. Math. Phys.*, **44**, 205–214.
- Śniatycki, J. [2001], Almost Poisson spaces and nonholonomic singular reduction, *Rep. Math. Phys.*, **48**, 235–248.
- Śniatycki, J. and W. Tulczyjew [1971], Canonical dynamics of relativistic charged particles, *Ann. Inst. H. Poincaré(Grenoble)* **15**, 177–187.
- Souriau, J.M. [1966], Quantification géométrique, *Comm. Math. Phys.*, **1**, 374–398.
- Souriau, J.-M. [1970], *Structure des Systèmes Dynamiques*, Dunod, Paris. English translation by R.H. Cushman and G.M Tuynman *Structure of Dynamical Systems*, volume 149 of Progress In Mathematics, Birkhäuser Boston Inc., Boston, MA, 1997.
- Spivak, M. [1979], *A Comprehensive Introduction to Differential Geometry*, Publish or Perish, Willmington, Delaware, 5 volumes.
- Sreenath, N., Y.G. Oh, P.S. Krishnaprasad, and J.E. Marsden [1988], The dynamics of coupled planar rigid bodies. Part 1: Reduction, equilibria and stability, *Dyn. and Stab. of Systems*, **3**, 25–49.
- Stefan, P. [1974a], Accessibility and foliations with singularities, *Bull. Amer. Math. Soc.*, **80**, 1142–1145.
- Stefan, P. [1974b], Accessible sets, orbits and foliations with singularities. *Proc. Lond. Math. Soc.*, **29**, 699–713.
- Sternberg, S. [1977], Minimal coupling and the symplectic mechanics of a classical particle in the presence of a Yang–Mills field, *Proc. Nat. Acad. Sci.*, **74**, 5253–5254.
- Sudarshan, E.C.G. and N. Mukunda [1974], *Classical Mechanics: A Modern Perspective*, Wiley, New York. Second edition, Krieger, Melbourne-Florida, 1983.
- Sussman, H. [1973], Orbits of families of vector fields and integrability of distributions, *Trans. Amer. Math. Soc.*, **180**, 171–188.
- Takhtajan, L. and L.P. Teo [2004], Weil–Petersson metric on the universal Teichmüller space I: curvature properties and Chern forms, *ArXiv, math.CV/0312172*, and Weil–Petersson metric on the universal Teichmüller space II: Kähler potential and period mapping, *ArXiv, math.CV/0406408*.
- Takhtajan, L. and L.P. Teo [2005], Weil–Petersson geometry of the universal Teichmüller space. In *Infinite dimensional algebras and quantum integrable systems*, *Progr. Math.*, **237**, 225–233, Birkhuser, Basel.
- Takhtajan, L. and L.P. Teo [2006], Weil–Petersson Metric on the Universal Teichmüller Space, *Memoirs of the AMS*, **183**.

- Tanimura, S. and T. Iwai [2000], Reduction of quantum systems on Riemannian manifolds with symmetry and application to molecular mechanics, *J. Math. Phys.*, **41**, 1814–1842.
- Teichmüller, O. [1939], Extremale quasikonforme Abbildungen und quadratische Differentiale, *Abh. Preuss. Akad. Wiss. Math.-Nat. Kl.*, **22**, 197 pp.
- Tromba, A.J. [1986], On a natural algebraic affine connection on the space of almost complex structures and the curvature of Teichmüller space with respect to its Weil-Petersson metric, *Manuscripta Math.*, **56**, 475–497.
- Tromba, A.J. [1992], *Teichmüller Theory in Riemannian Geometry*, Lecture notes prepared by Jochen Denzler; Lectures in Mathematics ETH Zrich, Birkhäuser Verlag, Basel.
- Tulczyjew, W.M. [1977], The Legendre transformation, *Ann. Inst. Poincaré*, **27**, 101–114.
- Tulczyjew, W.M. and P. Urbański [1999], A slow and careful Legendre transformation for singular Lagrangians, *Acta Phys. Polon. B* **30**, 2909–2978. The Infeld Centennial Meeting (Warsaw, 1998).
- Vaisman, I. [1994], *Lectures on the Geometry of Poisson Manifolds*, Progress in Mathematics, volume 118, Birkhäuser, Basel.
- Vanhaecke, P. [1996], *Integrable Systems in the Realm of Algebraic Geometry*, Lecture Notes in Math., volume 1638, Springer-Verlag, New York.
- Vasylykevych, S. and J.E. Marsden [2005], The Lie-Poisson structure of the Euler equations of an ideal fluid, *Dynamics of PDE*, **2** (4), 281–300.
- Vinogradov, A.M. and B.A. Kupershmidt [1977], The structures of Hamiltonian mechanics, *Russ. Math. Surv.*, **32**, 177–243.
- Vinti, J.P. [1998], *Orbital and Celestial Mechanics*, AIAA, Virginia.
- Wang, L.S. and P.S. Krishnaprasad [1992], Gyroscopic control and stabilization, *J. Nonlinear Sci.*, **2**, 367–415.
- Wang, L.S., P.S. Krishnaprasad, and J.H. Maddocks [1991], Hamiltonian dynamics of a rigid body in a central gravitational field, *Cel. Mech. Dyn. Astr.*, **50**, 349–386.
- Weinstein, A. [1971], Symplectic manifolds and their Lagrangian submanifolds, *Adv. Math.*, **6**, 329–346; see also *Bull. Am. Math. Soc.*, **75** (1969), pp. 1040–1041.
- Weinstein, A. [1973], Normal modes for nonlinear Hamiltonian systems, *Inv. Math.*, **20**, 47–57.
- Weinstein, A. [1977], *Lectures on Symplectic Manifolds*, **29**, CBMS Regional Conf. Ser. in Math., Conf. Board Math. Sci., Washington, DC.

- Weinstein, A. [1978a], A universal phase space for particles in Yang–Mills fields, *Lett. Math. Phys.*, **2**, 417–420.
- Weinstein, A. [1978b], Bifurcations and Hamilton’s principle, *Math. Zeit.*, **159**, 235–248.
- Weinstein, A. [1983a], The local structure of Poisson manifolds. *J. Differential Geometry*, **18**, 523–557.
- Weinstein, A. [1983b], Sophus Lie and symplectic geometry, *Expo. Math.*, **1**, 95–96.
- Weinstein, A. [1984], Stability of Poisson–Hamilton equilibria, *Contemp. Math.*, **28**, 3–14.
- Weinstein, A. [1990], Connections of Berry and Hannay type for moving Lagrangian submanifolds, *Adv. in Math.*, **82**, 133–159.
- Weinstein, A. [1996], Lagrangian mechanics and groupoids, *Fields Inst. Commun.*, **7**, 207–231.
- Wendlandt, J.M. and J.E. Marsden [1997], Mechanical integrators derived from a discrete variational principle, *Physica D*, **106**, 223–246.
- Whittaker, E.T. [1937], *A Treatise on the Analytical Dynamics of Particles and Rigid Bodies*, Cambridge University Press; First Edition 1904, Fourth Edition, 1937, Reprinted by Dover 1944 and Cambridge University Press, 1988, fourth edition.
- Witten, E. [1988], Coadjoint orbits of the Virasoro group. *Comm. Math. Phys.*, **114**, 1–53.
- Wolpert, S.A. [1983], On the symplectic geometry of deformations of a hyperbolic surface, *Ann. of Math.*, **117**, 207–234.
- Wolpert, S.A. [1986], Chern forms and the Riemann tensor for the moduli space of curves, *Invent. Math.*, **85**, 119–145.
- Wolpert, S.A. [2003], Geometry of the Weil-Petersson completion of Teichmüller space, in *Surveys in differential geometry, Vol. VIII (Boston, MA, 2002)*, Int. Press, Somerville, MA. *Surv. Differ. Geom.*, VIII, 357–393.
- Woodhouse, N.M.J. [1992], *Geometric Quantization*, Clarendon Press, Oxford.
- Wulff, C. [2003], Persistence of relative equilibria in Hamiltonian systems with non-compact symmetry, *Nonlinearity*, **16**, 67–91.
- Wulff, C. and M. Roberts [2002], Hamiltonian systems near relative periodic orbits, *SIAM J. Appl. Dyn. Syst.*, **1**, 1–43.
- Xu, P. [1991], Morita equivalent symplectic groupoids. In *Symplectic Geometry, Groupoids, and Integrable Systems*, Dazord, P. and Weinstein, A. (editors), 291–311, Springer Verlag.

- Zaalani, N. [1999], Phase space reduction and Poisson structure, *J. Math. Phys.*, **40**, 3431–3438.
- Zakrzewski, S. [1986], Induced representations and induced hamiltonian actions, *J. Geom. Phys.*, **3**, 211–219.
- Zenkov, D.V., A.M. Bloch, and J.E. Marsden [1998], The energy momentum method for the stability of nonholonomic systems, *Dyn. Stab. of Systems*, **13**, 123–166.
- Ziegler, F. [1996] *Méthode des Orbites et Représentations Quantiques*, Thesis, Université de Provence.
- Zygmund, A. [2002], *Trigonometric Series. Vol. I, II*, third edition, Cambridge University Press.

Index

Symbols

(B)-stratified
space, 39

A

Abelian
reduction, 62
action
adjoint, 4, 31, 44, 118, 124,
149, 415
affine, 6
coadjoint, 4, 118, 146, 148,
149, 158–160, 165, 193,
415, 416, 455, 476
free, 8, 101, 425, 433
Hamiltonian, 105, 168, 269,
473
induced, 118, 124
proper, 8, 101, 420, 446, 465,
466, 469, 470, 475, 478
symplectic, 3, 4, 114, 119, 121,
122, 124, 151, 168, 238
adjoint
action, 4, 31, 44, 118, 124,
149, 415

affine
action, 6
affine orbits
reduction to, 226
algebra
Lie, 44, 46, 118–120, 122, 130,
137, 143, 148, 186, 308
symmetry, 9
Virasoro, 266
amended
potential, 24, 25, 27
angular momentum, 5
annihilator, 9, 127, 156, 213, 401
lemma, 127
atlas
stratified, 39
singular, 39

B

Bianchi
identity, 51
bifurcation
points, 10
body
pseudo-rigid, 129

- rigid, 25, 29, 111, 114
- Bott
 - two-cocycle, 265
- Bott–Virasoro
 - group, 102, 106, 110, 249, 265, 271
- boundary, 37
 - piece, 37
- bracket
 - Lie–Poisson, 18, 25, 28, 118, 223
 - noncanonical, 29
 - semidirect product, 118
- bundle
 - cotangent, 5, 11, 29, 105, 129, 140, 145, 210, 211, 215, 225, 291, 293, 416, 447
 - cotangent bundle reduction, 60
 - frame, 52
 - picture, 30, 31
 - principal, 43
- C**
- Camassa–Holm
 - equation, xi, 106, 249, 255, 257
- canonical
 - decomposition associated to a stratification, 38
- Cartan
 - structure equations, 50
- center, 142
- central
 - extension, 31, 106, 124, 131, 147, 177, 192, 202, 237, 238, 241, 249–251, 257, 265, 293
- chart
 - stratified, 38
 - compatible stratified, 39
 - cone, 40
 - link, 40
 - singular, 38
- classification of
 - coadjoint orbits, 106, 110
- clean
 - value, 16
- cleanly, 16
 - intersect, 13
- closed
 - locally, 37
- coadjoint
 - action, 4, 118, 146, 148, 149, 158–160, 165, 193, 415, 416, 455, 476
 - form, 11
 - isotropy, 7
 - orbit, 11, 16–18, 20, 119, 120, 133, 135, 147, 241, 413, 430, 454
- coadjoint orbits
 - classification of, 106, 110
 - reduction to, 18, 25
- coarser
 - decomposition, 38
- cocycle, 31, 103, 106, 110, 143, 146, 147, 155, 158, 176, 177, 210, 238, 251, 259, 260, 398, 418, 475
 - Gelfand–Fuchs, 102, 106, 268
 - identity, 6
 - Lie algebra, 238
 - nonequivariance, 5, 7
- coisotropic, 14
 - stratification, 90, 92
- commuting
 - reduction, 102, 111, 112, 117, 120
- Commuting Reduction Theorem, 115
- compatible
 - stratified charts, 39
- compressible
 - fluids, x, 33, 106, 117
- condition
 - frontier, 37
 - two-cocycle, 239
- condition (B)
 - Whitney, 39

Whitney, 39
 cone, 39
 spaces, 89
 chart, 40
 space, 37, 40
 vertex, 39
 connection, 44
 mechanical, 130–132, 208
 mechanical, 24, 27, 30, 46, 102,
 106, 135, 144, 237, 238,
 268, 287
 principal, 44
 convexity, 10, 33
 Coriolis
 term, 62
 cotangent
 bundle, 5, 11, 29, 105, 129,
 140, 145, 210, 211, 215,
 225, 291, 293, 416, 447
 cotangent bundle
 reduction, 11, 30, 59, 106, 120,
 130, 132, 133, 136, 139,
 215, 216, 238, 241, 291
 reduction theorem, 24
 cotangent bundle reduction
 bundle, 60
 embedding, 60
 covariant derivative
 exterior, 49
 curvature, 31, 49, 103

D

decomposed
 space, 37
 subspace, 38
 decomposed spaces
 morphism, 38
 decomposition, 37
 coarser, 38
 canonical associated to a strat-
 ification, 38
 equivalent, 38
 finer, 38
 depth, 37
 differentiable

 structure of a stratification,
 39
 dimension, 37
 dimensional
 infinite, xiii, 106–109, 131,
 176, 208, 251, 252, 254,
 266, 271, 279, 418
 direct
 product, 102, 112
 discrete, 36, 479
 distribution
 horizontal, 49
 generalized, 399–401, 408,
 412, 414, 422, 424, 432,
 436
 double
 spherical pendulum, 9
 dynamics
 reducing, 121
 reduction, 12

E

elimination of the
 node, 7, 25, 27
 embedding
 cotangent bundle reduction,
 60
 energy-momentum
 method, 29, 32, 106
 equation
 KdV, xi, 106, 249, 255, 257,
 265, 266
 Camassa-Holm, xi, 106, 249,
 255, 257
 equations
 Euler-Poincaré, 26, 27, 31
 Maurer-Cartan, 55
 equilibrium
 relative, 25
 equivalent
 decomposition, 38
 sets, 38
 equivariance, 5, 44, 55, 121, 125,
 126, 145, 461
 infinitesimal, 4
 equivariant, 4

Euclidean
 group, 33, 103, 106, 111, 118,
 120, 129, 135, 208, 257
 Euler-Poincaré
 equations, 26, 27, 31
 reduction, 25, 26
 extension, 284
 property, 427
 central, 31, 106, 124, 131, 147,
 177, 192, 202, 237, 238,
 241, 249–251, 257, 265,
 293
 exterior
 covariant derivative, 49
F
 falling cat, 32
 finer
 decomposition, 38
 first
 reduced space, 119, 131, 132,
 136, 145, 146, 156, 158,
 169, 170, 173, 250, 259,
 267, 293
 First Isotopy Lemma
 Thom, 40
 fixed point
 submanifold, 41
 flat, 130–132, 208
 flow
 Hamiltonian, 403, 411, 417,
 429, 461, 472
 fluid, xiii, 25, 27, 29, 31, 73, 107,
 108, 111, 129, 267, 277–
 279
 fluids
 compressible, x, 33, 106, 117
 form
 Maurer-Cartan, 134
 coadjoint, 11
 KKS, 11
 Maurer-Cartan, 55, 240, 289
 frame
 bundle, 52
 orthonormal, 53

free
 action, 8, 101, 425, 433
 infinitesimally, 8
 locally, 8
 frontier
 condition, 37
 function
 momentum, 224
G
 gauge
 theory, 30
 Gelfand-Fuchs
 cocycle, 102, 106, 268
 two-cocycle, 266
 generalized
 distribution, 399–401, 408,
 412, 414, 422, 424, 432,
 436
 generic
 point, 17
 geometric
 mechanics, 1
 phases, 12
 germ
 set, 38
 group
 Euclidean, 135, 208
 Bott-Virasoro, 102, 106, 110,
 249, 265, 271
 Euclidean, 33, 103, 106, 111,
 118, 120, 129, 257
 Heisenberg, 110, 142, 143,
 152, 249, 250
 isotropy, 33, 150, 210
 loop, 110, 249, 251, 255
 multiplication, 11, 17, 117,
 176, 250, 265
 oscillator, 257, 258
 two-cocycle, 142, 238
 gyroscopic
 term, 62

H
 Hamilton-Poincaré, 32

Hamiltonian, 12, 21, 25, 28, 108,
 121, 128, 256, 257, 422,
 433, 443, 473, 477
 reduced, 42
 action, 105, 168, 269, 473
 flow, 403, 411, 417, 429, 461,
 472
 reduction, 31, 478
 vector field, 4, 12, 21, 118,
 402, 409, 410, 423, 442,
 467
 Hamiltonian G -space, 4
 Hannay-Berry
 phases, 12
 heavy
 top, x , 25, 32, 33, 108, 112
 Heisenberg
 group, 110, 142, 143, 152, 249,
 250
 horizontal
 distribution, 49
 vectors, 49
 lift, 46
 projection, 45
 space, 45
 hypothesis
 stages, 110, 141, 147, 160, 161,
 163–167, 169, 170, 173,
 199, 202, 204, 206, 416,
 466–468
 hypothesis II
 stages, 398, 414

I

identity
 Bianchi, 51
 cocycle, 6
 two-cocycle, 7
 incident, 37
 induced, 104
 action, 118, 124
 momentum map, 124
 representations, 104
 induction
 symplectic, 103, 104

induction by
 stages, 103
 infinite
 dimensional, xiii, 106–109,
 131, 176, 208, 251, 252,
 254, 266, 271, 279, 418
 infinitesimal
 equivariance, 4
 infinitesimally
 free, 8
 initial
 submanifold, 21
 integrable
 systems, 12, 26, 28, 29, 249
 interior
 product, 145, 217
 intersect
 cleanly, 13
 isotropy, 119
 coadjoint, 7
 group, 33, 150, 210
 lattice, 40
 subgroup, 9, 120
 isotropy type
 submanifold, 41

K

KdV
 equation, xi, 106, 249, 255,
 257, 265, 266
 KKS
 form, 11

L

Lagrange
 top, 114
 Lagrange–Poincaré, 31
 Lagrangian
 Reduction, 30
 reduction, 25, 31, 33, 103,
 237, 418
 Lagrangian reduction by
 stages, 418
 lattice
 isotropy, 40

- Legendre
 - transformation, 32
- Lemma
 - Reduction, 13
- lemma
 - annihilator, 127
- Lie
 - algebra, 44, 46, 118–120, 122, 130, 137, 143, 148, 186, 308
- Lie algebra
 - cocycle, 238
 - oscillator, 258
 - two-cocycle, 189, 239, 285
- Lie algebroids, 31
- Lie-Poisson
 - bracket, 18, 25, 28, 118, 223
 - magnetic, 223
 - reduction, 25
- lift
 - horizontal, 46
- lifted action, 5
- link, 40
 - chart, 40
- locally
 - closed, 37
 - free, 8
- locally trivial
 - stratified space, 39
- locked inertia
 - tensor, 24, 47, 134, 144
- locomotion, 29, 106
- loop
 - group, 110, 249, 251, 255
- M**
- magnetic
 - Lie-Poisson, 223
 - orbit symplectic form, 226
 - term, 62, 120, 145, 237, 241, 244, 293
 - terms, 24, 103, 132, 209, 237
- magnetohydrodynamics, x, 117
- map
 - momentum, 138
 - momentum, 3–5, 7, 8, 10, 13, 18, 21, 22, 26, 27, 30–33, 101, 104, 105, 112, 114, 115, 119, 121, 122, 124, 125, 141, 145, 146, 148, 152, 154–156, 158, 168, 172, 173, 209, 211, 225, 238
 - shift, 65, 72, 133, 216, 242, 292
 - stratified, 38
- Maurer–Cartan
 - equations, 55
 - form, 55, 134, 240, 289
- mechanical
 - connection, 132
 - connection, 24, 27, 30, 46, 102, 106, 130, 131, 135, 144, 208, 237, 238, 268, 287
- mechanics, 5, 7, 24–28, 30–32, 35, 36, 106, 111
 - geometric, 1
- method
 - energy-momentum, 29, 32, 106
- moment, 5
- momentum
 - function, 224
 - map, 3–5, 7, 8, 10, 13, 18, 21, 22, 26, 27, 30–33, 101, 104, 105, 112, 114, 115, 119, 121, 122, 124, 125, 138, 141, 145, 146, 148, 152, 154–156, 158, 168, 172, 173, 209, 211, 225, 238
- momentum map
 - induced, 124
 - nonequivariant, 17, 155, 260
 - optimal, 34, 395, 419, 421, 422, 425–427, 431, 432, 435, 438, 442, 445, 447, 448, 454–456, 463, 473, 475, 477
- morphism
 - of decomposed spaces, 38

multiplication
 group, 11, 17, 117, 176, 250, 265
 multisymplectic, 35, 418

N

node
 elimination of the, 7, 25, 27
 noncanonical
 bracket, 29
 Poisson bracket, 28
 nonequivariance
 cocycle, 5
 nonequivariance cocycle, 7
 nonequivariant
 momentum map, 17, 155, 260
 nonholonomic, 32, 35

O

optimal
 reduction, xi, 419, 432, 459, 462, 464, 473
 momentum map, 34, 395, 419, 421, 422, 425–427, 431, 432, 435, 438, 442, 445, 447, 448, 454–456, 463, 473, 475, 477
 orbit
 coadjoint, 133
 coadjoint, 11, 16–18, 20, 119, 120, 135, 147, 241, 413, 430, 454
 reduction, 10, 11, 20
 stages hypothesis, 470
 type, 89
 orbit reduction by
 stages, 169
 Orbit Reduction by Stages
 Theorem, 173
 orbit symplectic form
 magnetic, 226
 orbit type
 submanifold, 41
 orthogonal
 symplectic, 12

orthonormal
 frame, 53
 oscillator
 group, 257, 258
 Lie algebra, 258

P

pendulum
 spherical, 89
 phases
 geometric, 12
 Hannay-Berry, 12
 picture
 bundle, 30, 31
 piece
 boundary, 37
 pieces, 37
 point
 generic, 17
 reduction, 10, 20, 147
 regular, 17
 singular, 9, 33
 point reduction by
 stages, 169
 point strata
 singular symplectic, 42
 points
 bifurcation, 10
 Poisson
 reduction, 29, 31, 102, 147, 169, 170, 418
 Poisson bracket
 noncanonical, 28
 Poisson reduction by
 stages, 169
 potential, 209
 amended, 24, 25, 27
 principal
 bundle, 43
 connection, 44
 product, 159
 semidirect, 130, 132
 direct, 102, 112
 interior, 145, 217

- semidirect, 117, 119, 121, 123, 129, 150, 177, 192, 307
- projection
 - horizontal, 45
 - vertical, 45
- proper
 - action, 8, 101, 420, 446, 465, 466, 469, 470, 475, 478
- property
 - extension, 427
- pseudo-rigid
 - body, 129
- R**
- reconstruction, 12
- reduced
 - Hamiltonian, 42
 - symplectic form, 10, 11, 18, 63, 64, 124, 146, 163, 215, 220, 229
- reduced space
 - first, 119, 131, 132, 136, 145, 146, 156, 158, 169, 170, 173, 250, 259, 267, 293
 - second, 120, 146, 149, 158
 - symplectic, 8
 - two-stage, 120
- reducing
 - dynamics, 121
- Reduction
 - Lagrangian, 30
 - Lemma, 13
 - Routh, 32
 - Semidirect Product, 32
- reduction
 - optimal, xi, 419, 432, 459, 462, 464, 473
 - Abelian, 62
 - commuting, 102, 111, 112, 117, 120
 - cotangent bundle, 11, 30, 59, 106, 120, 130, 132, 133, 136, 139, 215, 216, 238, 241, 291
 - dynamics, 12
 - Euler-Poincaré, 25, 26
 - Hamiltonian, 31, 478
 - Lagrangian, 25, 31, 33, 103, 237, 418
 - Lie-Poisson, 25
 - orbit, 10, 11, 20
 - point, 10, 20, 147
 - Poisson, 29, 31, 102, 147, 169, 170, 418
 - Routh, 103
 - semidirect product, 33, 102, 103, 106, 110, 111, 119–121, 129, 130
 - singular, 12, 33, 34, 101
 - singular cotangent bundle, 88
 - symplectic, 3, 7, 27, 32, 35, 101, 103, 110, 418, 419, 431
 - theory, 27
- reduction at
 - zero, 62
- reduction by
 - stages, x, xi, 17, 31, 33, 101–103, 106, 110, 111, 117, 119–121, 125, 129, 132, 141, 147, 160, 161, 167, 237, 241, 251, 291, 293, 299, 395, 396, 398, 408, 414, 415, 417, 418, 420, 459, 474, 475
- reduction theorem
 - cotangent bundle, 24
- reduction to
 - affine orbits, 226
 - coadjoint orbits, 18, 25
- regular
 - point, 17
 - value, 9, 13, 16, 18, 105, 122, 148, 226, 412
- relative
 - equilibrium, 25
- representation
 - unitary, 103
- representations
 - induced, 104

- resonances, 9
- rigid
 - body, 25, 29, 111, 114
- Routh
 - Reduction, 32
 - reduction, 103
- S**
- seam, 90
- second
 - reduced space, 120, 146, 149, 158
- secondary
 - stratification, 91
 - stratification, 89, 91
- semidirect
 - product, 117, 119, 121, 123, 129, 130, 132, 150, 177, 192, 307
- Semidirect Product
 - Reduction, 32
- semidirect product
 - reduction, 130
 - bracket, 118
 - reduction, 33, 102, 103, 106, 110, 111, 119–121, 129
- semidirect product reduction
 - theorem, 119, 120
- set
 - germ, 38
- sets
 - equivalent, 38
- shape
 - space, 43
- shift
 - map, 65, 72, 133, 216, 242, 292
- shift map
 - total, 216
- Shifting
 - Theorem, 173
- singular
 - atlas, 39
 - chart, 38
 - point, 9, 33
 - reduction, 12, 33, 34, 101
 - symplectic reduction, 36
- singular cotangent bundle
 - reduction, 88
- singular symplectic
 - point strata, 42
- skeleton, 37
- smooth
 - stratified space, 39
 - structure of a stratification, 39
- space
 - (B)- stratified, 39
 - cone, 37, 40
 - decomposed, 37
 - horizontal, 45
 - shape, 43
 - stratified, 38
 - vertical, 45
 - Whitney, 39
- spaces
 - cone, 89
- spherical
 - pendulum, 89
- spherical pendulum
 - double, 9
- stages
 - hypothesis, 110, 141, 147, 160, 161, 163–167, 169, 170, 173, 199, 202, 204, 206, 416, 466–468
 - hypothesis II, 398, 414
 - induction by, 103
 - Lagrangian reduction by, 418
 - orbit reduction by, 169
 - point reduction by, 169
 - Poisson reduction by, 169
 - reduction by, x , xi , 17, 31, 33, 101–103, 106, 110, 111, 117, 119–121, 125, 129, 132, 141, 147, 160, 161, 167, 237, 241, 251, 291, 293, 299, 395, 396, 398, 408, 414, 415, 417, 418, 420, 459, 474, 475

- symplectic induction by, 105
- stages hypothesis
 - orbit, 470
- strata, 38, 89
- stratification, 38
 - differentiable structure, 39
 - secondary, 89, 91
 - coisotropic, 90, 92
 - smooth structure, 39
 - theorem, 41
- stratified
 - atlas, 39
 - chart, 38
 - map, 38
 - space, 38
- stratified space
 - locally trivial, 39
 - smooth, 39
- structure equations
 - Cartan, 50
- subgerm, 38
- subgroup
 - isotropy, 9, 120
- submanifold
 - fixed point, 41
 - initial, 21
 - isotropy type, 41
 - orbit type, 41
 - type, 41
- subspace
 - decomposed, 38
- symmetry
 - algebra, 9
- symplectic
 - action, 3, 4, 114, 119, 121, 122, 124, 151, 168, 238
 - induction, 103, 104
 - orthogonal, 12
 - reduced space, 8
 - reduction, 3, 7, 27, 32, 35, 101, 103, 110, 418, 419, 431
- symplectic form

- reduced, 10, 11, 18, 63, 64, 124, 146, 163, 215, 220, 229
- symplectic induction by
 - stages, 105
- Symplectic Orbit Reduction Theorem, 21
- symplectic reduction
 - singular, 36
 - theorem, 10
- symplectic stratification
 - theorem, 37, 41
- systems
 - integrable, 12, 26, 28, 29, 249

T

- Teichmüller, xiv, 275, 277
- tensor
 - locked inertia, 24, 47, 134, 144
- term
 - Coriolis, 62
 - gyroscopic, 62
 - magnetic, 62, 120, 145, 237, 241, 244, 293
- terms
 - magnetic, 24, 103, 132, 209, 237
- Theorem
 - Commuting Reduction, 115
 - Orbit Reduction by Stages, 173
 - Shifting, 173
 - Symplectic Orbit Reduction, 21
- theorem
 - stratification, 41
 - semidirect product reduction, 119, 120
 - symplectic reduction, 10
 - symplectic stratification, 37, 41
- theory
 - gauge, 30
 - reduction, 27

Thom
 First Isotopy Lemma,
 40
 top
 heavy, x , 25, 32, 33, 108,
 112
 Lagrange, 114
 total
 shift map, 216
 transformation
 Legendre, 32
 two-cocycle
 Bott, 265
 condition, 239
 Gelfand-Fuchs, 266
 group, 142, 238
 Lie algebra, 189, 239,
 285
 two-cocycle identity, 7
 two-stage
 reduced space, 120
 type
 orbit, 89
 submanifold, 41

U
 underwater
 vehicle, 102, 103, 106, 117,
 121, 129
 unitary
 representation, 103

V
 value
 clean, 16
 regular, 9, 13, 16, 18, 105,
 122, 148, 226, 412
 vector field
 Hamiltonian, 4, 12, 21, 118,
 402, 409, 410, 423, 442,
 467
 vectors
 horizontal, 49
 vertical, 49
 vehicle
 underwater, 102, 103, 106,
 117, 121, 129
 vertex
 of a cone, 39
 vertical, 44
 vectors, 49
 projection, 45
 space, 45
 Virasoro
 algebra, 266

W
 Whitney
 space, 39
 condition (B), 39

Z
 zero
 reduction at, 62

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