

Bibliography

- [1] R.H. Abraham and J.E. Marsden. *Foundations of Mechanics (2nd edition)*. Benjamin/Cummings, 1978.
- [2] J.F. Adams. *Lectures on Lie Groups*. Benjamin, New York, 1969.
- [3] V.I. Arnol'd. On the stability of an equilibrium point of a Hamiltonian system of ordinary differential equations in the general elliptic case. *Sov. Math. Dokl.*, 2(2): 247–249, 1961.
- [4] V.I. Arnol'd. Proof of a theorem by A.N. Kolmogorov on the persistence of quasi-periodic motions under small perturbations of the Hamiltonian. *Russian Math. Surveys*, 18(5): 9–36, 1963.
- [5] V.I. Arnol'd. Small denominators and problems of stability of motion in classical and celestial mechanics. *Russian Math. Surveys*, 18(6): 85–191, 1963. [Corrigenda (in Russian): *Uspekhi Mat. Nauk*, 23(6): 216, 1968].
- [6] V.I. Arnol'd. On Liouville's theorem concerning integrable problems of dynamics. *Sibirsk. Mat. Zh.*, 4(2): 471–474, 1963 [in Russian].
- [7] V.I. Arnol'd. On the instability of dynamical systems with many degrees of freedom. *Sov. Math. Dokl.*, 5(3): 581–585, 1964.
- [8] V.I. Arnol'd. Small divisors I. On mappings of the circle onto itself. *Amer. Math. Soc. Transl., Ser. 2*, 46: 213–284, 1965. [Russian original: *Izvest. Akad. Nauk SSSR, Ser. Mat.*, 25(1): 21–86, 1961; Corrigenda: *ibid.*, 28(2): 479–480, 1964].
- [9] V.I. Arnol'd. On matrices depending on parameters. *Russian Math. Surveys*, 26(2): 29–43, 1971.
- [10] V.I. Arnol'd. Lectures on bifurcations and versal families. *Russian Math. Surveys*, 27(5): 54–123, 1972.
- [11] V.I. Arnol'd. Reversible systems. In R.Z. Sagdeev, editor, *Nonlinear and Turbulent Processes in Physics* (Kiev, 1983), Vol. 3, pages 1161–1174. Harwood Academic, Chur, New York, 1984.
- [12] V.I. Arnol'd. *Geometrical Methods in the Theory of Ordinary Differential Equations (2nd edition)*. Springer-Verlag, 1988. [Russian original: Nauka, Moscow, 1978].
- [13] V.I. Arnol'd. *Mathematical Methods of Classical Mechanics (2nd edition)*. Springer-Verlag, 1989. [Russian original: Nauka, Moscow, 1974].

- [14] V.I. Arnol'd. About A.N. Kolmogorov. In A.N. Shiryayev, editor, *Kolmogorov in Recollections*, pages 144–172. Nauka, Moscow, 1993 [in Russian].
- [15] V.I. Arnol'd. Catastrophe theory. In V.I. Arnol'd, editor, *Encyclopædia of Mathematical Sciences, Vol. 5, Dynamical Systems V*, pages 207–264. Springer-Verlag, 1994.
- [16] V.I. Arnol'd, V.S. Afraïmovich, Yu.S. Il'yashenko, and L.P. Shil'nikov. Bifurcation theory. In V.I. Arnol'd, editor, *Encyclopædia of Mathematical Sciences, Vol. 5, Dynamical Systems V*, pages 1–205. Springer-Verlag, 1994.
- [17] V.I. Arnol'd and A. Avez. *Ergodic Problems of Classical Mechanics*. Addison-Wesley, 1989. [French original: Gauthier-Villars, 1968].
- [18] V.I. Arnol'd and A.B. Givental'. Symplectic geometry. In V.I. Arnol'd and S.P. Novikov, editors, *Encyclopædia of Mathematical Sciences, Vol. 4, Dynamical Systems IV*, pages 1–136. Springer-Verlag, 1990.
- [19] V.I. Arnol'd and Yu.S. Il'yashenko. Ordinary differential equations. In D.V. Anosov and V.I. Arnol'd, editors, *Encyclopædia of Mathematical Sciences, Vol. 1, Dynamical Systems I*, pages 1–148. Springer-Verlag, 1988.
- [20] V.I. Arnol'd, V.V. Kozlov, and A.I. Neishtadt. Mathematical aspects of classical and celestial mechanics. In V.I. Arnol'd, editor, *Encyclopædia of Mathematical Sciences, Vol. 3, Dynamical Systems III*, pages 1–291. Springer-Verlag, 1988 [2nd edition: 1993].
- [21] V.I. Arnol'd and L.D. Meshalkin. A.N. Kolmogorov's seminar on selected topics in analysis (1958–59). *Uspekhi Mat. Nauk*, 15(1): 247–250, 1960 [in Russian].
- [22] V.I. Arnol'd and M.B. Sevryuk. Oscillations and bifurcations in reversible systems. In R.Z. Sagdeev, editor, *Nonlinear Phenomena in Plasma Physics and Hydrodynamics*, pages 31–64. Mir, Moscow, 1986.
- [23] V.I. Bakhtin. Averaging in multifrequency systems. *Funct. Anal. Appl.*, 20(2): 83–88, 1986.
- [24] V.I. Bakhtin. A strengthened extremal property of Chebyshev polynomials. *Moscow Univ. Math. Bull.*, 42(2): 24–26, 1987.
- [25] V.I. Bakhtin. Diophantine approximations on images of mappings. *Dokl. Akad. Nauk Beloruss. SSR*, 35(5): 398–400, 1991 [in Russian].
- [26] È.G. Belaga. On the reducibility of a system of ordinary differential equations in a neighborhood of a conditionally periodic motion. *Sov. Math. Dokl.*, 3(2): 360–364, 1962.
- [27] G.R. Belitskiĭ. *Normal Forms, Invariants, and Local Mappings*. Naukova Dumka, Kiev, 1979 [in Russian].
- [28] A.A. Bel'kovich. On the existence of invariant tori for a periodic Hamiltonian system having some of characteristic indices with non-zero real part. *Diff. Equat.*, 23(2): 133–138, 1987.

- [29] G. Benettin, L. Galgani, and A. Giorgilli. A proof of Nekhoroshev's theorem for the stability times in nearly integrable Hamiltonian systems. *Celest. Mech.*, 37(1): 1–25, 1985.
- [30] G. Benettin, L. Galgani, A. Giorgilli, and J.-M. Strelcyn. A proof of Kolmogorov's theorem on invariant tori using canonical transformations defined by the Lie method. *Nuovo Cimento B*, 79(2): 201–223, 1984.
- [31] G. Benettin and G. Gallavotti. Stability of motions near resonances in quasi-integrable Hamiltonian systems. *J. Stat. Phys.*, 44(3–4): 293–338, 1986.
- [32] P. Bergé, Y. Pomeau, and C. Vidal. *Order within Chaos. Towards a Deterministic Approach to Turbulence*. John Wiley, New York, 1986. [French original: Hermann, 1984].
- [33] D. Bernstein and A. Katok. Birkhoff periodic orbits for small perturbations of completely integrable Hamiltonian systems with convex Hamiltonians. *Invent. Math.*, 88(2): 225–241, 1987.
- [34] A. Bhowal, T.K. Roy, and A. Lahiri. Small-angle Krein collisions in a family of four-dimensional reversible maps. *Phys. Rev. E*, 47(6): 3932–3940, 1993.
- [35] Yu.N. Bibikov. On the existence of invariant tori in a neighborhood of the equilibrium state of a system of differential equations. *Sov. Math. Dokl.*, 10(2): 261–265, 1969.
- [36] Yu.N. Bibikov. The existence of conditionally periodic solutions of systems of differential equations. *Diff. Equat.*, 7(8): 1021–1027, 1971.
- [37] Yu.N. Bibikov. A sharpening of a theorem of Moser. *Sov. Math. Dokl.*, 14(6): 1769–1773, 1973.
- [38] Yu.N. Bibikov. *Local Theory of Nonlinear Analytic Ordinary Differential Equations*. Lect. Notes Math., Vol. 702. Springer-Verlag, 1979.
- [39] Yu.N. Bibikov. *Multifrequency Nonlinear Oscillations and their Bifurcations*. Leningrad Univ. Press, 1991 [in Russian].
- [40] Yu.N. Bibikov and V.A. Pliss. On the existence of invariant tori in a neighborhood of the zero solution of a system of ordinary differential equations. *Diff. Equat.*, 3(11): 967–976, 1967.
- [41] G.D. Birkhoff. *Dynamical Systems*. AMS Colloquium Publications, Vol. IX, 1927 [revised edition: 1966].
- [42] N.N. Bogolyubov, Yu.A. Mitropol'skiĭ, and A.M. Samoilenko. *Methods of Accelerated Convergence in Nonlinear Mechanics*. Springer-Verlag, 1976. [Russian original: Naukova Dumka, Kiev, 1969].
- [43] J.-B. Bost. Tores invariants des systèmes dynamiques hamiltoniens (d'après Kolmogorov, Arnol'd, Moser, Rüssmann, Zehnder, Herman, Pöschel, ...). In *Séminaire Bourbaki*, Vol. 639, 1984–85, pages 113–157. Astérisque, 133–134, 1986.

- [44] N. Bourbaki. *Éléments de Mathématique. Fasc. XXI. Livre V: Intégration. Chapitre V (2ième édition)*. Hermann, 1967.
- [45] N. Bourbaki. *Elements of Mathematics. Algebra I. Chapters 1-3*. Springer-Verlag, 1989. [French original: Hermann, 1970].
- [46] B.L.J. Braaksma and H.W. Broer. Quasi-periodic flow near a codimension one singularity of a divergence free vector field in dimension four. In *Bifurcation, Théorie Ergodique et Applications* (Dijon, 1981), pages 74-142. Astérisque, 98-99, 1982.
- [47] B.L.J. Braaksma and H.W. Broer. On a quasi-periodic Hopf bifurcation. *Ann. Institut Henri Poincaré, Analyse non linéaire*, 4(2): 115-168, 1987.
- [48] B.L.J. Braaksma, H.W. Broer, and G.B. Huitema. Towards a quasi-periodic bifurcation theory. *Mem. Amer. Math. Soc.*, 83(421): 83-170, 1990.
- [49] H. Brands, J.S.W. Lamb, and I. Hoveijn. Periodic orbits in k -symmetric dynamical systems. *Physica D*, 84(3-4): 460-475, 1995.
- [50] G.E. Bredon. *Introduction to Compact Transformation Groups*. Acad. Press, 1972.
- [51] T.J. Bridges. Symplecticity, reversibility and elliptic operators. In H.W. Broer, S.A. van Gils, I. Hoveijn, and F. Takens, editors, *Nonlinear Dynamical Systems and Chaos* (Proceedings of the Dynamical Systems Conference, Groningen, December 1995), pages 1-20. Birkhäuser, Basel, 1996.
- [52] H.W. Broer. Formal normal form theorems for vector fields and some consequences for bifurcations in the volume preserving case. In D.A. Rand and L.S. Young, editors, *Dynamical Systems and Turbulence*, Lect. Notes Math., Vol. 898, pages 54-74. Springer-Verlag, 1981.
- [53] H.W. Broer. Quasi-periodic flow near a codimension one singularity of a divergence free vector field in dimension three. In D.A. Rand and L.S. Young, editors, *Dynamical Systems and Turbulence*, Lect. Notes Math., Vol. 898, pages 75-89. Springer-Verlag, 1981.
- [54] H.W. Broer. Quasi-periodicity in local bifurcation theory. In C.P. Bruter, A. Aragnol, and A. Lichnerowicz, editors, *Bifurcation Theory, Mechanics and Physics*, pages 177-208. Reidel, 1983. [Reprinted from *Nieuw Arch. Wisk.* 4, 1(1): 1-32, 1983].
- [55] H.W. Broer. On some quasi-periodic bifurcations. *Delft Progress Report*, 12(1): 79-96, 1988.
- [56] H.W. Broer. Quasi-periodic bifurcations, applications. In *Proceedings of the XIth Congress on Differential Equations and Applications / First Congress on Applied Mathematics* (Málaga, 1989), pages 3-21. University of Málaga, 1990.
- [57] H.W. Broer. KAM theory: multi-periodicity in conservative and dissipative systems. *Nieuw Arch. Wisk.* 4, 14(1): 65-79, 1996.
- [58] H.W. Broer, F. Dumortier, S.J. van Strien, and F. Takens. *Structures in Dynamics (Finite Dimensional Deterministic Studies)*. Studies Math. Phys., Vol. 2. North-Holland, Elsevier, 1991.

- [59] H.W. Broer and G.B. Huitema. A proof of the isoenergetic KAM-theorem from the "ordinary" one. *J. Differ. Eq.*, 90(1): 52–60, 1991.
- [60] H.W. Broer and G.B. Huitema. Unfoldings of quasi-periodic tori in reversible systems. *J. Dynam. Differ. Eq.*, 7(1): 191–212, 1995.
- [61] H.W. Broer, G.B. Huitema, and M.B. Sevryuk. Families of quasi-periodic motions in dynamical systems depending on parameters. In H.W. Broer, S.A. van Gils, I. Hoveijn, and F. Takens, editors, *Nonlinear Dynamical Systems and Chaos* (Proceedings of the Dynamical Systems Conference, Groningen, December 1995), pages 171–211. Birkhäuser, Basel, 1996.
- [62] H.W. Broer, G.B. Huitema, and F. Takens. Unfoldings of quasi-periodic tori. *Mem. Amer. Math. Soc.*, 83(421): 1–81, 1990.
- [63] H.W. Broer and F. Takens. Formally symmetric normal forms and genericity. In U. Kirchgraber and H.-O. Walther, editors, *Dynamics Reported*, Vol. 2, pages 39–59. Wiley, Chichester, 1989.
- [64] H.W. Broer and F. Takens. Mixed spectra and rotational symmetry. *Arch. Rat. Mech. Anal.*, 124(1): 13–42, 1993.
- [65] H.W. Broer and F.M. Tangerman. From a differentiable to a real analytic perturbation theory, applications to the Kupka–Smale theorems. *Ergod. Th. and Dynam. Syst.*, 6(3): 345–362, 1986.
- [66] H.W. Broer and G. Vegter. Bifurcational aspects of parametric resonance. In C.K.R.T. Jones, U. Kirchgraber, and H.-O. Walther, editors, *Dynamics Reported (New Series)*, Vol. 1, pages 1–53. Springer-Verlag, 1992.
- [67] I.U. Bronstein and A.Ya. Kopanskiĭ. *Smooth Invariant Manifolds and Normal Forms*. World Scientific, River Edge, 1994. [Russian original: Shtiintsa, Kishinĕv, 1992].
- [68] I.U. Bronstein and A.Ya. Kopanskiĭ. Normal forms of vector fields satisfying certain geometric conditions. In H.W. Broer, S.A. van Gils, I. Hoveijn, and F. Takens, editors, *Nonlinear Dynamical Systems and Chaos* (Proceedings of the Dynamical Systems Conference, Groningen, December 1995), pages 79–101. Birkhäuser, Basel, 1996.
- [69] Yu.A. Brudnyiĭ and P.A. Shvartsman. Generalizations of Whitney's extension theorem. *Intern. Math. Res. Notices (electronic)*, (3): 129 ff. (≈ 11 pp.), 1994.
- [70] A.D. Bruno. Analytical form of differential equations, I and II. *Trans. Moscow Math. Soc.*, 25: 131–288, 1971 and 26: 199–239, 1972.
- [71] A.D. Bruno. The normal form of a Hamiltonian system. *Russian Math. Surveys*, 43(1): 25–66, 1988.
- [72] A.D. Bruno. *Local Methods in Nonlinear Differential Equations*. Springer-Verlag, 1989. [Russian original of Part I: Nauka, Moscow, 1979. Russian original of Part II: Akad. Nauk SSSR Inst. Prikl. Mat., preprints 97 and 98, 1974].

- [73] A.D. Bruno. Normalization of a Hamiltonian system near an invariant cycle or torus. *Russian Math. Surveys*, 44(2): 53–89, 1989.
- [74] A.D. Bruno. On conditions for nondegeneracy in Kolmogorov's theorem. *Sov. Math. Dokl.*, 45(1): 221–225, 1992.
- [75] A.D. Bruno. *The Restricted 3-Body Problem: Plane Periodic Orbits*. Walter de Gruyter, Berlin, 1994. [Russian original: Nauka, Moscow, 1990].
- [76] P. Brunovský. On one-parameter families of diffeomorphisms. *Comment. Math. Universitatis Carolinae*, 11(3): 559–582, 1970.
- [77] P. Brunovský. On one-parameter families of diffeomorphisms II: Generic branching in higher dimensions. *Comment. Math. Universitatis Carolinae*, 12(4): 765–784, 1971.
- [78] A. Celletti and L. Chierchia. Construction of analytic KAM surfaces and effective stability bounds. *Commun. Math. Phys.*, 118(1): 119–161, 1988.
- [79] A. Celletti and L. Chierchia. Invariant curves for area-preserving twist maps far from integrable. *J. Stat. Phys.*, 65(3–4): 617–643, 1991.
- [80] A. Celletti and C. Froeschlé. On the determination of the stochasticity threshold of invariant curves. *Intern. J. Bifurcation and Chaos*, 5(6): 1713–1719, 1995.
- [81] A. Chenciner. Bifurcations de points fixes elliptiques, I. Courbes invariantes. *Publ. Math. I.H.E.S.*, 61: 67–127, 1985.
- [82] A. Chenciner. Bifurcations de points fixes elliptiques, II. Orbites périodiques et ensembles de Cantor invariants. *Invent. Math.*, 80(1): 81–106, 1985.
- [83] A. Chenciner. La dynamique au voisinage d'un point fixe elliptique conservatif: de Poincaré et Birkhoff à Aubry et Mather. In *Séminaire Bourbaki*, Vol. 622, 1983–84, pages 147–170. Astérisque, 121–122, 1985.
- [84] A. Chenciner. Bifurcations de points fixes elliptiques, III. Orbites périodiques de “petites” périodes et élimination résonnante des couples de courbes invariantes. *Publ. Math. I.H.E.S.*, 66: 5–91, 1988.
- [85] A. Chenciner and G. Iooss. Bifurcations de tores invariants. *Arch. Rat. Mech. Anal.*, 69(2): 109–198, 1979.
- [86] A. Chenciner and G. Iooss. Persistance et bifurcation de tores invariants. *Arch. Rat. Mech. Anal.*, 71(4): 301–306, 1979.
- [87] Ch.-Q. Cheng. Birkhoff–Kolmogorov–Arnol'd–Moser tori in convex Hamiltonian systems. *Commun. Math. Phys.*, 177(3): 529–559, 1996.
- [88] Ch.-Q. Cheng and Y.-S. Sun. Existence of invariant tori in three-dimensional measure-preserving mappings. *Celest. Mech. Dynam. Astronom.*, 47(3): 275–292, 1990.

- [89] Ch.-Q. Cheng and Y.-S. Sun. Existence of KAM tori in degenerate Hamiltonian systems. *J. Differ. Eq.*, 114(1): 288–335, 1994.
- [90] L. Chierchia. On the stability problem for nearly-integrable Hamiltonian systems. In S.B. Kuksin, V.F. Lazutkin, and J. Pöschel, editors, *Seminar on Dynamical Systems* (St. Petersburg, 1991), pages 35–46. Birkhäuser, Basel, 1994.
- [91] L. Chierchia and C. Falcolini. A direct proof of a theorem by Kolmogorov in Hamiltonian systems. *Ann. Sc. Norm. Super. Pisa, Sci. Fis. Mat., IV Ser.*, 21(4): 541–593, 1994.
- [92] L. Chierchia and C. Falcolini. Compensations in small divisor problems. *Commun. Math. Phys.*, 175(1): 135–160, 1996.
- [93] L. Chierchia and G. Gallavotti. Smooth prime integrals for quasi-integrable Hamiltonian systems. *Nuovo Cimento B*, 67(2): 277–295, 1982.
- [94] L. Chierchia and G. Gallavotti. Drift and diffusion in phase space. *Ann. Institut Henri Poincaré, Physique théorique*, 60(1): 1–144, 1994.
- [95] B.V. Chirikov. A universal instability of many-dimensional oscillator systems. *Phys. Rep.*, 52(5): 263–379, 1979.
- [96] B.V. Chirikov and V.V. Vecheslavov. KAM integrability. In P.H. Rabinowitz and E. Zehnder, editors, *Analysis, et cetera* (research papers published in honor of J. Moser's 60th birthday), pages 219–236. Acad. Press, 1990.
- [97] S.-N. Chow, K. Lu, and Y.-Q. Shen. Normal form and linearization for quasiperiodic systems. *Trans. Amer. Math. Soc.*, 331(1): 361–376, 1992.
- [98] J.D. Crawford. Introduction to bifurcation theory. *Rev. Modern Phys.*, 63(4): 991–1037, 1991.
- [99] R. Cushman and J.-C. van der Meer. The Hamiltonian Hopf bifurcation in the Lagrange top. In C. Albert, editor, *Proceedings of the 5th Colloque International: Géométrie Symplectique et Mécanique*, Lect. Notes Math., Vol. 1416, pages 26–38. Springer-Verlag, 1990.
- [100] H.H. de Jong. The measure of invariant subtori in a row of coupled pendulums (*in preparation*).
- [101] A. Delshams and R. de la Llave. Existence of quasi-periodic orbits and lack of transport for volume preserving transformations and flows. 1991 (*preprint*).
- [102] A. Delshams and P. Gutiérrez. Estimates on invariant tori near an elliptic equilibrium point of a Hamiltonian system. *J. Differ. Eq.* (*to appear*).
- [103] A. Delshams and P. Gutiérrez. Effective stability and KAM theory. *J. Differ. Eq.*, 128(2): 415–490, 1996.

- [104] A. Delshams and P. Gutiérrez. Exponentially small estimates for KAM theorem near an elliptic equilibrium point. In C. Simó, editor, *Hamiltonian Systems with Three or More Degrees of Freedom* (S'Agaró, Spain, 1995), NATO ASI Series C: Math. Physics. Kluwer Academic, Dordrecht, 1996 (to appear).
- [105] R.L. Devaney. Reversible diffeomorphisms and flows. *Trans. Amer. Math. Soc.*, 218: 89–113, 1976.
- [106] R.L. Devaney. Blue sky catastrophes in reversible and Hamiltonian systems. *Indiana Univ. Math. J.*, 26(2): 247–263, 1977.
- [107] R. Douady. Une démonstration directe de l'équivalence des théorèmes de tores invariants pour difféomorphismes et champs de vecteurs. *C. R. Acad. Sci. Paris, Série I*, 295(2): 201–204, 1982.
- [108] H. Dulac. Solutions d'un système d'équations différentielles dans le voisinage des valeurs singulières. *Bull. Soc. Math. France*, 40: 324–383, 1912.
- [109] L.H. Eliasson. Perturbations of stable invariant tori for Hamiltonian systems. *Ann. Sc. Norm. Super. Pisa, Cl. Sci., IV Ser.*, 15(1): 115–147, 1988.
- [110] L.H. Eliasson. Absolutely convergent series expansions for quasi-periodic motions. University of Stockholm, 1988 (report 2-88).
- [111] L.H. Eliasson. Hamiltonian systems with linear normal form near an invariant torus. In G. Turchetti, editor, *Nonlinear Dynamics* (Bologna, 1988), pages 11–29. World Sci. Publishing, Teaneck, NJ, 1989.
- [112] L.H. Eliasson. Generalization of an estimate of small divisors by Siegel. In P.H. Rabinowitz and E. Zehnder, editors, *Analysis, et cetera* (research papers published in honor of J. Moser's 60th birthday), pages 283–299. Acad. Press, 1990.
- [113] C. Falcolini. Compensations in small divisor problems. In C. Simó, editor, *Hamiltonian Systems with Three or More Degrees of Freedom* (S'Agaró, Spain, 1995), NATO ASI Series C: Math. Physics. Kluwer Academic, Dordrecht, 1996 (to appear).
- [114] H. Federer. *Geometric Measure Theory*. Springer-Verlag, 1969 [latest edition: 1996].
- [115] N. Fenichel. Persistence and smoothness of invariant manifolds for flows. *Indiana Univ. Math. J.*, 21(3): 193–226, 1971.
- [116] D. Flockerzi. Generalized bifurcation of higher dimensional tori. *J. Differ. Eq.*, 55(3): 346–367, 1984.
- [117] M. Friedman. Quasi-periodic solutions of nonlinear ordinary differential equations with small damping. *Bull. Amer. Math. Soc.*, 73(3): 460–464, 1967.
- [118] G. Gaeta. Normal forms of reversible dynamical systems. *Intern. J. Theor. Phys.*, 33(9): 1917–1928, 1994.
- [119] D.M. Galin. On real matrices depending on parameters. *Uspekhi Mat. Nauk*, 27(1): 241–242, 1972 [in Russian].

- [120] D.M. Galin. Versal deformations of linear Hamiltonian systems. *Amer. Math. Soc. Transl., Ser. 2*, 118: 1–12, 1982. [Russian original: *Trudy Sem. im. I.G. Petrovskogo*, 1: 63–74, 1975].
- [121] G. Gallavotti. Twistless KAM tori. *Commun. Math. Phys.*, 164(1): 145–156, 1994.
- [122] G. Gallavotti. Twistless KAM tori, quasi flat homoclinic intersections, and other cancellations in the perturbation series of certain completely integrable Hamiltonian systems. A review. *Rev. Math. Phys.*, 6(3): 343–411, 1994.
- [123] G. Gallavotti and G. Gentile. Majorant series convergence for twistless KAM tori. *Ergod. Th. and Dynam. Syst.*, 15(5): 857–869, 1995.
- [124] G. Gallavotti, G. Gentile, and V. Mastropietro. Field theory and KAM tori. *Math. Phys. Electron. J. (electronic)*, 1(5): ≈ 13 pp., 1995.
- [125] G. Gentile. A proof of existence of whiskered tori with quasi-flat homoclinic intersections in a class of almost integrable Hamiltonian systems. *Forum Math.*, 7(6): 709–753, 1995.
- [126] G. Gentile. Whiskered tori with prefixed frequencies and Lyapunov spectrum. *Dynam. Stability Syst.*, 10(3): 269–308, 1995.
- [127] G. Gentile and V. Mastropietro. Tree expansion and multiscale analysis for KAM tori. *Nonlinearity*, 8(6): 1159–1178, 1995.
- [128] G. Gentile and V. Mastropietro. Convergence of the Lindstedt series for KAM tori. 1995 (*preprint*).
- [129] G. Gentile and V. Mastropietro. KAM theorem revisited. *Physica D*, 90(3): 225–234, 1996.
- [130] G. Gentile and V. Mastropietro. Methods for the analysis of the Lindstedt series for KAM tori and renormalizability in classical mechanics. A review with some applications. *Rev. Math. Phys.*, 8(3): 393–444, 1996.
- [131] A. Giorgilli, A. Delshams, E. Fontich, L. Galgani, and C. Simó. Effective stability for a Hamiltonian system near an elliptic equilibrium point, with an application to the restricted three body problem. *J. Differ. Eq.*, 77(1): 167–198, 1989.
- [132] A. Giorgilli and L. Galgani. Rigorous estimates for the series expansions of Hamiltonian perturbation theory. *Celest. Mech.*, 37(2): 95–112, 1985.
- [133] A. Giorgilli and U. Locatelli. Kolmogorov theorem and classical perturbation theory. 1995 (*preprint*).
- [134] A. Giorgilli and A. Morbidelli. Invariant KAM tori and global stability for Hamiltonian systems. 1995 (*preprint*).
- [135] A.F. Golubchikov. On the structure of automorphisms of complex simple Lie groups. *Dokl. Akad. Nauk SSSR*, 77(1): 7–9, 1951 [in Russian].

- [136] M. Golubitsky, J.E. Marsden, I. Stewart, and M. Dellnitz. The constrained Liapunov-Schmidt procedure and periodic orbits. In W.F. Langford and W. Nagata, editors, *Normal Forms and Homoclinic Chaos* (Waterloo, Canada, 1992), Fields Institute Communications, Vol. 4, pages 81-127. Amer. Math. Soc., Providence, RI, 1995.
- [137] S.M. Graff. On the conservation of hyperbolic invariant tori for Hamiltonian systems. *J. Differ. Eq.*, 15(1): 1-69, 1974.
- [138] S.M. Graff. Invariant tori for a class of Hamiltonian differential equations. In T.M. Rassias, editor, *Global Analysis - Analysis on Manifolds*, Teubner-Texte Math., Vol. 57, pages 111-125. Teubner-Verlag, Leipzig, 1983.
- [139] J.M. Greene. A method for determining a stochastic transition. *J. Math. Phys.*, 20(6): 1183-1201, 1979.
- [140] J.M. Greene. The status of KAM theory from a physicist's point of view. In G. Brown and A. Opie, editors, *Chaos in Australia* (Sydney, 1990), pages 8-23. World Scientific, River Edge, 1993.
- [141] G. Haller and S. Wiggins. N -pulse homoclinic orbits in perturbations of resonant Hamiltonian systems. *Arch. Rat. Mech. Anal.*, 130(1): 25-101, 1995.
- [142] G. Haller and S. Wiggins. Whiskered tori and chaos in resonant Hamiltonian normal forms. In W.F. Langford and W. Nagata, editors, *Normal Forms and Homoclinic Chaos* (Waterloo, Canada, 1992), Fields Institute Communications, Vol. 4, pages 129-149. Amer. Math. Soc., Providence, RI, 1995.
- [143] H. Hanßmann. The quasi-periodic centre-saddle bifurcation (*in preparation*).
- [144] H. Hanßmann. Normal forms for perturbations of the Euler top. In W.F. Langford and W. Nagata, editors, *Normal Forms and Homoclinic Chaos* (Waterloo, Canada, 1992), Fields Institute Communications, Vol. 4, pages 151-173. Amer. Math. Soc., Providence, RI, 1995.
- [145] H. Hanßmann. *Quasi-periodic motions of a rigid body - a case study on perturbations of superintegrable systems*. PhD thesis, University of Groningen, 1995.
- [146] H. Hanßmann. Equivariant perturbations of the Euler top. In H.W. Broer, S.A. van Gils, I. Hoveijn, and F. Takens, editors, *Nonlinear Dynamical Systems and Chaos* (Proceedings of the Dynamical Systems Conference, Groningen, December 1995), pages 227-252. Birkhäuser, Basel, 1996.
- [147] F. Hausdorff. *Set Theory (2nd edition)*. Chelsea Publishing Co., New York, 1962. [German original: Veit (Leipzig), 1914; de Gruyter (Berlin), 1927].
- [148] M.R. Herman. Construction d'un difféomorphisme minimal d'entropie topologique non nulle. *Ergod. Th. and Dynam. Syst.*, 1(1): 65-76, 1981.
- [149] M.R. Herman. Une méthode pour minorer les exposants de Lyapounov et quelques exemples montrant le caractère local d'un théorème d'Arnol'd et de Moser sur le tore de dimension 2. *Comment. Math. Helvetici*, 58(3): 453-502, 1983.

- [150] M.R. Herman. *Sur les courbes invariantes par les difféomorphismes de l'anneau*, Vol. 1 et 2. Astérisque, 103–104, 1983 and 144, 1986.
- [151] M.R. Herman. Simple proofs of local conjugacy theorems for diffeomorphisms of the circle with almost every rotation number. *Bol. Soc. Bras. Mat.*, 16(1): 45–83, 1985.
- [152] M.R. Herman. Existence et non existence de tores invariants par des difféomorphismes symplectiques. École Polytechnique (Palaiseau, France), 1988 (*preprint*).
- [153] M.R. Herman. *Talk held on the International Conference on Dynamical Systems* (Lyons), 1990.
- [154] M.R. Herman. Inégalités “a priori” pour des tores lagrangiens invariants par des difféomorphismes symplectiques. *Publ. Math. I.H.E.S.*, 70: 47–101, 1990.
- [155] M.R. Herman. Différentiabilité optimale et contre-exemples à la fermeture en topologie C^∞ des orbites récurrentes de flots hamiltoniens. *C. R. Acad. Sci. Paris, Série I*, 313(1): 49–51, 1991.
- [156] M.R. Herman. Exemples de flots hamiltoniens dont aucune perturbation en topologie C^∞ n'a d'orbites périodiques sur un ouvert de surfaces d'énergies. *C. R. Acad. Sci. Paris, Série I*, 312(13): 989–994, 1991.
- [157] M.W. Hirsch. *Differential Topology*. Springer-Verlag, 1976.
- [158] M.W. Hirsch, C.C. Pugh, and M. Shub. *Invariant Manifolds*. Lect. Notes Math., Vol. 583. Springer-Verlag, 1977.
- [159] P.J. Holmes and J.E. Marsden. Mel'nikov's method and Arnol'd diffusion for perturbations of integrable Hamiltonian systems. *J. Math. Phys.*, 23(4): 669–675, 1982.
- [160] L. Hörmander. On the division of distributions by polynomials. *Ark. Mat.*, 3(6): 555–568, 1958.
- [161] I. Hoveijn. Versal deformations and normal forms for reversible and Hamiltonian linear systems. *J. Differ. Eq.*, 126(2): 408–442, 1996.
- [162] G.B. Huitema. *Unfoldings of quasi-periodic tori*. PhD thesis, University of Groningen, 1988.
- [163] Yu.S. Il'yashenko. A steepness condition for analytic functions. *Russian Math. Surveys*, 41(1): 229–230, 1986.
- [164] Yu.S. Il'yashenko. Stability of the equilibrium points in Hamiltonian systems with two degrees of freedom. L'Institut de Recherche Mathématique Avancée (Strasbourg, France), 1990 (*preprint 437/P-249*).
- [165] Yu.S. Il'yashenko and S.Yu. Yakovenko. Finitely-smooth normal forms of local families of diffeomorphisms and vector fields. *Russian Math. Surveys*, 46(1): 1–43, 1991.
- [166] Yu.S. Il'yashenko and S.Yu. Yakovenko. Nonlinear Stokes phenomena in smooth classification problems. In Yu.S. Il'yashenko, editor, *Nonlinear Stokes Phenomena*, Advances Soviet Math., Vol. 14, pages 235–287. Amer. Math. Soc., Providence, RI, 1993.

- [167] G. Iooss and J.E. Los. Quasi-genericity of bifurcations to high dimensional invariant tori for maps. *Commun. Math. Phys.*, 119(3): 453–500, 1988.
- [168] R.A. Johnson and G.R. Sell. Smoothness of spectral subbundles and reducibility of quasi-periodic linear differential systems. *J. Differ. Eq.*, 41(2): 262–288, 1981.
- [169] À. Jorba, R. de la Llave, and M. Zou. Lindstedt series for lower dimensional tori. In C. Simó, editor, *Hamiltonian Systems with Three or More Degrees of Freedom* (S'Agaró, Spain, 1995), NATO ASI Series C: Math. Physics. Kluwer Academic, Dordrecht, 1996 (*to appear*).
- [170] À. Jorba and C. Simó. On quasiperiodic perturbations of elliptic equilibrium points. *SIAM J. Math. Anal.* (*to appear*).
- [171] À. Jorba and C. Simó. On the reducibility of linear differential equations with quasiperiodic coefficients. *J. Differ. Eq.*, 98(1): 111–124, 1992.
- [172] À. Jorba and J. Villanueva. On the persistence of lower dimensional invariant tori under quasiperiodic perturbations. 1996 (*preprint*).
- [173] Y. Katznelson. *An Introduction to Harmonic Analysis*. John Wiley, New York, 1968.
- [174] A. Kelley. On the Liapounov subcenter manifold. *J. Math. Anal. Appl.*, 18(3): 472–478, 1967.
- [175] U. Kirchgraber. A note on Liapunov's center theorem. *J. Math. Anal. Appl.*, 73(2): 568–570, 1980.
- [176] J. Knobloch and A. Vanderbauwhede. Hopf bifurcation at k -fold resonances in reversible systems. TU Ilmenau, 1995 (*preprint No. M 16/95*).
- [177] J. Knobloch and A. Vanderbauwhede. Hopf bifurcation at k -fold resonances in conservative systems. In H.W. Broer, S.A. van Gils, I. Hoveijn, and F. Takens, editors, *Nonlinear Dynamical Systems and Chaos* (Proceedings of the Dynamical Systems Conference, Groningen, December 1995), pages 155–170. Birkhäuser, Basel, 1996.
- [178] H. Koçak. Normal forms and versal deformations of linear Hamiltonian systems. *J. Differ. Eq.*, 51(3): 359–407, 1984.
- [179] A.N. Kolmogorov. On the persistence of conditionally periodic motions under a small change of the Hamilton function. *Dokl. Akad. Nauk SSSR*, 98(4): 527–530, 1954 [in Russian]. [The English translation in G. Casati and J. Ford, editors, *Stochastic Behavior in Classical and Quantum Hamiltonian Systems*, Lect. Notes Phys., Vol. 93, pages 51–56. Springer-Verlag, 1979. Reprinted in: Bai Lin Hao, editor, *Chaos*, pages 81–86. World Scientific, 1984].
- [180] A.N. Kolmogorov. The general theory of dynamical systems and classical mechanics. In *Proceedings of International Congress of Mathematicians* (Amsterdam, 1954), Vol. 1, pages 315–333. North-Holland, Amsterdam, 1957 [in Russian]. [Reprinted in: *International Mathematical Congress in Amsterdam, 1954 (Plenary Lectures)*, pages 187–208. Fizmatgiz, Moscow, 1961. The English translation as Appendix D in R.H.

- Abraham. *Foundations of Mechanics*, pages 263–279. Benjamin, 1967. Reprinted as Appendix in R.H. Abraham and J.E. Marsden. *Foundations of Mechanics (2nd edition)*, pages 741–757. Benjamin/Cummings, 1978].
- [181] V.V. Kozlov. *Qualitative Analysis Methods in Rigid Body Dynamics*. Moscow Univ. Press, 1980 [in Russian].
- [182] V.V. Kozlov. Integrability and non-integrability in Hamiltonian mechanics. *Russian Math. Surveys*, 38(1): 1–76, 1983.
- [183] V.V. Kozlov. *Symmetries, Topology, and Resonances in Hamiltonian Mechanics*. Springer-Verlag, 1996. [Russian original: Udmurt. Univ. Press, Izhevsk, 1995].
- [184] S.B. Kuksin. An infinitesimal Liouville–Arnol’d theorem as a criterion of reducibility for variational Hamiltonian equations. *Chaos, Solitons & Fractals*, 2(3): 259–269, 1992.
- [185] S.B. Kuksin. *Nearly Integrable Infinite-Dimensional Hamiltonian Systems*. Lect. Notes Math., Vol. 1556. Springer-Verlag, 1993.
- [186] S.B. Kuksin. KAM theory for partial differential equations. In A. Joseph, F. Mignot, F. Murat, B. Prum, and R. Rentschler, editors, *Proceedings of the First European Congress of Mathematics (Paris, 1992), Invited Lectures, Vol. II*, Progress in Mathematics, Vol. 120, pages 123–157. Birkhäuser, Basel, 1994.
- [187] A. Lahiri, A. Bhowal, and T.K. Roy. Fourth order resonant collisions of multipliers in reversible maps: Period-4 orbits and invariant curves. *Physica D*, 85(1–2): 10–24, 1995.
- [188] A. Lahiri, A. Bhowal, T.K. Roy, and M.B. Sevryuk. Stability of invariant curves in four-dimensional reversible mappings near 1 : 1 resonance. *Physica D*, 63(1–2): 99–116, 1993.
- [189] J.S.W. Lamb. Reversing symmetries in dynamical systems. *J. Phys. A: Math. Gen.*, 25(4): 925–937, 1992.
- [190] J.S.W. Lamb. *Reversing symmetries in dynamical systems*. PhD thesis, University of Amsterdam, 1994.
- [191] J.S.W. Lamb. Local bifurcations in k -symmetric dynamical systems. *Nonlinearity*, 9(2): 537–557, 1996.
- [192] J.S.W. Lamb and M. Nicol. On symmetric ω -limit sets in reversible flows. In H.W. Broer, S.A. van Gils, I. Hoveijn, and F. Takens, editors, *Nonlinear Dynamical Systems and Chaos (Proceedings of the Dynamical Systems Conference, Groningen, December 1995)*, pages 103–120. Birkhäuser, Basel, 1996.
- [193] J.S.W. Lamb and G.R.W. Quispel. Reversing k -symmetries in dynamical systems. *Physica D*, 73(4): 277–304, 1994.
- [194] J.S.W. Lamb and G.R.W. Quispel. Cyclic reversing k -symmetry groups. *Nonlinearity*, 8(6): 1005–1026, 1995.

- [195] J.S.W. Lamb, J.A.G. Roberts, and H.W. Capel. Conditions for local (reversing) symmetries in dynamical systems. *Physica A*, 197(3): 379–422, 1993.
- [196] P. Lancaster and M. Tismenetsky. *The Theory of Matrices (2nd edition)*. Academic, Orlando, Fla., 1985.
- [197] V.F. Lazutkin. The existence of a continuum of closed invariant curves for a convex billiard. *Uspekhi Mat. Nauk*, 27(3): 201–202, 1972 [in Russian].
- [198] V.F. Lazutkin. The existence of caustics for a billiard problem in a convex domain. *Math. USSR Izv.*, 7(1): 185–214, 1973.
- [199] V.F. Lazutkin. Concerning Moser's theorem on invariant curves. In *Problems in the Dynamical Theory of Seismic Waves Propagation*, Vol. 14, pages 109–120. Nauka, Leningrad, 1974 [in Russian].
- [200] V.F. Lazutkin. *Convex Billiard and Eigenfunctions of the Laplace Operator*. Leningrad Univ. Press, 1981 [in Russian].
- [201] V.F. Lazutkin. *KAM Theory and Semiclassical Approximations to Eigenfunctions*. Springer-Verlag, 1993.
- [202] A.J. Lichtenberg and M.A. Lieberman. *Regular and Chaotic Dynamics (2nd edition)*. Springer-Verlag, 1992.
- [203] B.B. Lieberman. Quasi-periodic solutions of Hamiltonian systems. *J. Differ. Eq.*, 11(1): 109–137, 1972.
- [204] P. Lochak. Canonical perturbation theory via simultaneous approximation. *Russian Math. Surveys*, 47(6): 57–133, 1992.
- [205] P. Lochak. Hamiltonian perturbation theory: periodic orbits, resonances and intermittency. *Nonlinearity*, 6(6): 885–904, 1993.
- [206] P. Lochak. Stability of Hamiltonian systems over exponentially long times: the near-linear case. In H.S. Dumas, K.R. Meyer, and D.S. Schmidt, editors, *Hamiltonian Dynamical Systems: History, Theory, and Applications* (Cincinnati, 1992), The IMA Volumes in Math. and Appl., Vol. 63, pages 221–229. Springer-Verlag, 1995.
- [207] P. Lochak. Arnol'd diffusion; a compendium of remarks and questions. 1995 (*pre-print*).
- [208] P. Lochak. Long time stability of many-dimensional Hamiltonian systems. In C. Simó, editor, *Hamiltonian Systems with Three or More Degrees of Freedom* (S'Agaró, Spain, 1995), NATO ASI Series C: Math. Physics. Kluwer Academic, Dordrecht, 1996 (*to appear*).
- [209] P. Lochak and A.I. Neishtadt. Estimates of stability time for nearly integrable systems with a quasiconvex Hamiltonian. *Chaos*, 2(4): 495–499, 1992.

- [210] P. Lochak, A.I. Neishtadt, and L. Niederman. Stability of nearly integrable convex Hamiltonian systems over exponentially long times. In S.B. Kuksin, V.F. Lazutkin, and J. Pöschel, editors, *Seminar on Dynamical Systems* (St. Petersburg, 1991), pages 15–34. Birkhäuser, Basel, 1994.
- [211] A.M. Lyapunov. *The General Problem of the Stability of Motion*. Taylor & Francis, London, 1992. [Russian original: Math. Soc. of Khar'kov, 1892. The French translation: *Problème Général de la Stabilité du Mouvement*. Ann. Math. Studies, Vol. 17. Princeton Univ. Press and Oxford Univ. Press, 1947].
- [212] R.S. MacKay. Transition to chaos for area-preserving maps. In J.M. Jowett, M. Month, and S. Turner, editors, *Nonlinear Dynamics Aspects of Particle Accelerators*, Lect. Notes Phys., Vol. 247, pages 390–454. Springer-Verlag, 1986.
- [213] R.S. MacKay. Converse KAM theory. In St. Pnevmatikos, T. Bountis, and Sp. Pnevmatikos, editors, *Singular Behavior and Nonlinear Dynamics*, Vol. 1, pages 109–113. World Sci. Publishing, Teaneck, NJ, 1989.
- [214] R.S. MacKay. A criterion for nonexistence of invariant tori for Hamiltonian systems. *Physica D*, 36(1–2): 64–82, 1989.
- [215] R.S. MacKay. *Renormalisation in Area-Preserving Maps*. World Scientific, River Edge, 1993.
- [216] R.S. MacKay, J.D. Meiss, and I.C. Percival. Transport in Hamiltonian systems. *Physica D*, 13(1–2): 55–81, 1984.
- [217] R.S. MacKay, J.D. Meiss, and J. Stark. Converse KAM theory for symplectic twist maps. *Nonlinearity*, 2(4): 555–570, 1989.
- [218] R.S. MacKay and I.C. Percival. Converse KAM: theory and practice. *Commun. Math. Phys.*, 98(4): 469–512, 1985.
- [219] L. Markus and K.R. Meyer. Generic Hamiltonian dynamical systems are neither integrable nor ergodic. *Mem. Amer. Math. Soc.*, (144): 1–52, 1974.
- [220] J.E. Marsden and M. McCracken. *The Hopf Bifurcation and its Applications*. Springer-Verlag, 1976.
- [221] W.S. Massey. *A Basic Course in Algebraic Topology*. Springer-Verlag, 1991.
- [222] J.N. Mather. Nonexistence of invariant circles. *Ergod. Th. and Dynam. Syst.*, 4(2): 301–309, 1984.
- [223] J.N. Mather. A criterion for the nonexistence of invariant circles. *Publ. Math. I.H.E.S.*, 63: 153–204, 1986.
- [224] J.N. Mather and G. Forni. Action minimizing orbits in Hamiltonian systems. In S. Graffi, editor, *Transition to Chaos in Classical and Quantum Mechanics*, Lect. Notes Math., Vol. 1589, pages 92–186. Springer-Verlag, 1994.
- [225] M.V. Matveev. Lyapunov stability of equilibrium points in reversible systems. *Math. Notes*, 57(1–2): 63–72, 1995.

- [226] M.V. Matveev. *Stability of nonlinear reversible systems*. PhD thesis, Moscow State Aircraft Institute (Technical University), 1995 [in Russian].
- [227] M.V. Matveev. Lyapunov and effective stability in reversible systems. 1996 (*preprint*).
- [228] M.V. Matveev. Structure of the sets of invariant tori in the local KAM theory and problems of stability in reversible systems. In C. Simó, editor, *Hamiltonian Systems with Three or More Degrees of Freedom* (S'Agaró, Spain, 1995), NATO ASI Series C: Math. Physics. Kluwer Academic, Dordrecht, 1996 (*to appear*).
- [229] J.D. Meiss. Symplectic maps, variational principles, and transport. *Rev. Modern Phys.*, 64(3): 795–848, 1992.
- [230] I. Melbourne. Versal unfoldings of equivariant linear Hamiltonian vector fields. *Math. Proc. Camb. Phil. Soc.*, 114(3): 559–573, 1993.
- [231] V.K. Mel'nikov. On some cases of conservation of conditionally periodic motions under a small change of the Hamilton function. *Sov. Math. Dokl.*, 6(6): 1592–1596, 1965.
- [232] V.K. Mel'nikov. A family of conditionally periodic solutions of a Hamiltonian system. *Sov. Math. Dokl.*, 9(4): 882–886, 1968.
- [233] K.R. Meyer. Hamiltonian systems with a discrete symmetry. *J. Differ. Eq.*, 41(2): 228–238, 1981.
- [234] J. Milnor. *Morse Theory (5th printing)*. Ann. Math. Studies, Vol. 51. Princeton Univ. Press, 1973.
- [235] H.K. Moffatt. KAM-theory. *Bull. London Math. Soc.*, 22(1): 71–73, 1990.
- [236] D. Montgomery and L. Zippin. *Topological Transformation Groups*. Interscience, New York, 1955.
- [237] A. Morbidelli and A. Giorgilli. Quantitative perturbation theory by successive elimination of harmonics. *Celest. Mech. Dynam. Astronom.*, 55(2): 131–159, 1993.
- [238] A. Morbidelli and A. Giorgilli. On a connection between KAM and Nekhoroshev's theorems. *Physica D*, 86(3): 514–516, 1995.
- [239] A. Morbidelli and A. Giorgilli. Superexponential stability of KAM tori. *J. Stat. Phys.*, 78(5–6): 1607–1617, 1995.
- [240] A. Morbidelli and A. Giorgilli. Sur un lien entre le théorème KAM et le théorème de Nekhoroshev. 1995 (*preprint*).
- [241] A. Morbidelli and A. Giorgilli. Bounds on diffusion in phase space: Connections between KAM and Nekhoroshev's theorems and superexponential stability of invariant tori. In C. Simó, editor, *Hamiltonian Systems with Three or More Degrees of Freedom* (S'Agaró, Spain, 1995), NATO ASI Series C: Math. Physics. Kluwer Academic, Dordrecht, 1996 (*to appear*).

- [242] F. Morgan. *Geometric Measure Theory: A Beginner's Guide*. Acad. Press, 1988.
- [243] J. Moser. On invariant curves of area-preserving mappings of an annulus. *Nachr. Akad. Wiss. Göttingen, Math.-Phys. Kl. II*, (1): 1–20, 1962.
- [244] J. Moser. On the theory of quasiperiodic motions. *SIAM Review*, 8(2): 145–172, 1966.
- [245] J. Moser. A rapidly convergent iteration method and non-linear partial differential equations, I and II. *Ann. Sc. Norm. Super. Pisa, Sci. Fis. Mat., III Ser.*, 20(2): 265–315 and (3): 499–535, 1966.
- [246] J. Moser. Convergent series expansions for quasi-periodic motions. *Math. Ann.*, 169(1): 136–176, 1967.
- [247] J. Moser. Lectures on Hamiltonian systems. *Mem. Amer. Math. Soc.*, (81): 1–60, 1968 [3rd printing: 1989].
- [248] J. Moser. *Stable and Random Motions in Dynamical Systems, with Special Emphasis on Celestial Mechanics*. Ann. Math. Studies, Vol. 77. Princeton Univ. Press, 1973.
- [249] P. Moson. Quasi-periodic solutions of differential equations depending on parameters. *Z. Angew. Math. Mech.*, 65(4): 86–87, 1985.
- [250] P. Moson. Quasiperiodic solutions of differential equations depending on parameters, I and II. *Vestnik Leningrad. Univ. Mat. Mekh. Astronom.*, (2): 16–22, 1986 and (3): 34–39, 1986 [in Russian].
- [251] N.N. Nekhoroshev. On the behavior of Hamiltonian systems close to integrable ones. *Funct. Anal. Appl.*, 5(4): 338–339, 1971.
- [252] N.N. Nekhoroshev. Action-angle variables and their generalizations. *Trans. Moscow Math. Soc.*, 26: 180–198, 1972.
- [253] N.N. Nekhoroshev. Stable lower estimates for smooth mappings and the gradients of smooth functions. *Math. USSR Sbornik*, 19(3): 425–467, 1973.
- [254] N.N. Nekhoroshev. An exponential estimate of the stability time for Hamiltonian systems close to integrable ones, I. *Russian Math. Surveys*, 32(6): 1–65, 1977.
- [255] N.N. Nekhoroshev. An exponential estimate of the stability time for Hamiltonian systems close to integrable ones, II. In O.A. Oleĭnik, editor, *Topics in Modern Mathematics, Petrovskii Seminar, No. 5*, pages 1–58. Consultant Bureau, New York, 1985. [Russian original: *Trudy Sem. im. I.G. Petrovskogo*, 5: 5–50, 1979].
- [256] N.N. Nekhoroshev. The Poincaré–Lyapunov–Liouville–Arnol'd theorem. *Funct. Anal. Appl.*, 28(2): 128–129, 1994.
- [257] A.I. Neishtadt. Estimates in the Kolmogorov theorem on the persistence of quasiperiodic motions. *J. Appl. Math. Mech.*, 45(6): 766–772, 1981.
- [258] J.C. Oxtoby. *Measure and Category (2nd edition)*. Springer-Verlag, 1980.

- [259] R.E.A.C. Paley and N. Wiener. *Fourier Transforms in the Complex Domain*. AMS Colloquium Publications, Vol. XIX, 1934.
- [260] J. Palis and W.C. de Melo. *Geometric Theory of Dynamical Systems: An Introduction*. Springer-Verlag, 1982. [Portuguese original: IMPA, 1977].
- [261] K.J. Palmer. Linearization of reversible systems. *J. Math. Anal. Appl.*, 60(3): 794–808, 1977.
- [262] I.O. Parasyuk. Conservation of quasiperiodic motions in reversible multifrequency systems. *Dokl. Akad. Nauk Ukrain. SSR, Ser. A*, (9): 19–22, 1982 [in Russian].
- [263] I.O. Parasyuk. Conservation of multidimensional invariant tori in Hamiltonian systems. *Ukrain. Math. J.*, 36(4): 380–385, 1984.
- [264] I.O. Parasyuk. Coisotropic invariant tori of Hamiltonian systems in the quasiclassical theory of motion of a conduction electron. *Ukrain. Math. J.*, 42(3): 308–312, 1990.
- [265] M.M. Peixoto. On an approximation theorem of Kupka and Smale. *J. Differ. Eq.*, 3(2): 214–227, 1967.
- [266] I.C. Percival. A variational principle for invariant tori of fixed frequency. *J. Phys. A: Math. Gen.*, 12(3): L57–L60, 1979.
- [267] I.C. Percival. Variational principles for invariant tori and cantori. In M. Month and J.C. Herrera, editors, *Nonlinear Dynamics and the Beam-Beam Interaction*, AIP Conference Proceedings, Vol. 57, pages 302–310. AIP Press, New York, 1980.
- [268] I.C. Percival. Chaos in Hamiltonian systems. *Proc. Roy. Soc. London, Ser. A*, 413(1844): 131–143, 1987.
- [269] I.C. Percival, R.S. MacKay, and J.D. Meiss. Transport in Hamiltonian systems. In R.Z. Sagdeev, editor, *Nonlinear and Turbulent Processes in Physics* (Kiev, 1983), Vol. 3, pages 1557–1572. Harwood Academic, Chur, New York, 1984.
- [270] A.D. Perry and S. Wiggins. KAM tori are very sticky: rigorous lower bounds on the time to move away from an invariant Lagrangian torus with linear flow. *Physica D*, 71(1–2): 102–121, 1994.
- [271] E. Piña and L. Jiménez Lara. On the symmetry lines of the standard mapping. *Physica D*, 26(1–3): 369–378, 1987.
- [272] P.I. Plotnikov. Morse theory for quasi-periodic solutions of Hamiltonian systems. *Siberian Math. J.*, 35(3): 590–604, 1994.
- [273] W. Pluschke. *Bifurcations of quasi-periodic solutions from fixed points of differentiable reversible systems*. PhD thesis, University of Stuttgart, 1989.
- [274] H. Poincaré. *Sur les propriétés des fonctions définies par les équations aux dérivées partielles*. Thèse, Paris, 1879. [Reprinted in: *Œuvres de Henri Poincaré*, Vol. 1, Gauthier-Villars, 1928].

- [275] H. Poincaré. *Les Méthodes Nouvelles de la Mécanique Céleste, I-III*. Dover Publications, 1957. [Original: Gauthier-Villars, 1892, 1893, 1899. The English translation: *New Methods of Celestial Mechanics*. AIP Press, Williston, 1992].
- [276] G. Pólya and G. Szegő. *Problems and Theorems in Analysis, Vol. I and II*. Springer-Verlag, 1972 and 1976. [German original: Springer-Verlag, 1925, 1954, 1964].
- [277] J. Pöschel. *Über invariante Tori in differenzierbaren Hamiltonschen Systemen*. Diplomarbeit, *Bonn. Math. Schr.*, Band 120, 1980.
- [278] J. Pöschel. Integrability of Hamiltonian systems on Cantor sets. *Comm. Pure Appl. Math.*, 35(5): 653–696, 1982.
- [279] J. Pöschel. On elliptic lower dimensional tori in Hamiltonian systems. *Math. Z.*, 202(4): 559–608, 1989.
- [280] J. Pöschel. *On small divisors with spatial structure*. Habilitationsschrift, Rheinische Friedrich-Wilhelms-Universität, Bonn, 1989.
- [281] J. Pöschel. Small divisors with spatial structure in infinite dimensional Hamiltonian systems. *Commun. Math. Phys.*, 127(2): 351–393, 1990.
- [282] J. Pöschel. A lecture on the classical KAM theorem. ETH-Zürich, 1992 (*preprint*).
- [283] J. Pöschel. Nekhoroshev estimates for quasi-convex Hamiltonian systems. *Math. Z.*, 213(2): 187–216, 1993.
- [284] T. Post, H.W. Capel, G.R.W. Quispel, and J.P. van der Wee. Bifurcations in two-dimensional reversible maps. *Physica A*, 164(3): 625–662, 1990.
- [285] G.E. Prince, G.B. Byrnes, J. Sherring, and S.E. Godfrey. A generalization of the Liouville–Arnol’d theorem. *Math. Proc. Camb. Phil. Soc.*, 117(2): 353–370, 1995.
- [286] A.S. Pyartli. Diophantine approximations on submanifolds of Euclidean space. *Funct. Anal. Appl.*, 3(4): 303–306, 1969.
- [287] G.R.W. Quispel and M.B. Sevryuk. KAM theorems for the product of two involutions of different types. *Chaos*, 3(4): 757–769, 1993.
- [288] W.P. Reinhardt. Chaos and collisions: introductory concepts. In F.A. Gianturco, editor, *Collision Theory for Atoms and Molecules*, NATO ASI Series B: Physics, Vol. 196, pages 465–518. Plenum Press, 1989.
- [289] K.V. Rerikh. Non-algebraic integrability of the Chew–Low reversible dynamical system of the Cremona type and the relation with the 7th Hilbert problem (non-resonant case). *Physica D*, 82(1–2): 60–78, 1995.
- [290] R.J. Rimmer. Generic bifurcations for involutory area-preserving maps. *Mem. Amer. Math. Soc.*, 41(272): 1–165, 1983.
- [291] J.A.G. Roberts and M. Baake. Trace maps as 3D reversible dynamical systems with an invariant. *J. Stat. Phys.*, 74(3–4): 829–888, 1994.

- [292] J.A.G. Roberts and G.R.W. Quispel. Chaos and time-reversal symmetry. Order and chaos in reversible dynamical systems. *Phys. Rep.*, 216(2-3): 63-177, 1992.
- [293] R.C. Robinson. Generic properties of conservative systems, I and II. *Amer. J. Math.*, 92(3): 562-603 and (4): 897-906, 1970.
- [294] T.K. Roy and A. Lahiri. Reversible Hopf bifurcation in four-dimensional maps. *Phys. Rev. A*, 44(8): 4937-4944, 1991.
- [295] M. Rudnev and S. Wiggins. KAM theory near multiplicity one resonant surfaces in perturbations of *a priori* stable Hamiltonian systems. 1996 (preprint).
- [296] D. Ruelle. Strange attractors. *Math. Intelligencer*, 2(3): 126-137, 1980. [French original: *La Recherche* N° 108, Février 1980].
- [297] D. Ruelle and F. Takens. On the nature of turbulence. *Commun. Math. Phys.*, 20(3): 167-192, 1971 and 23(4): 343-344, 1971.
- [298] H. Rüssmann. Kleine Nenner I: Über invariante Kurven differenzierbarer Abbildungen eines Kreisinges. *Nachr. Akad. Wiss. Göttingen, Math.-Phys. Kl. II*, (5): 67-105, 1970.
- [299] H. Rüssmann. Kleine Nenner II: Bemerkungen zur Newtonschen Methode. *Nachr. Akad. Wiss. Göttingen, Math.-Phys. Kl. II*, (1): 1-10, 1972.
- [300] H. Rüssmann. Konvergente Reihenentwicklungen in der Störungstheorie der Himmelsmechanik. In K. Jacobs, editor, *Selecta Mathematica V (German)*, Heidelberger Taschenbücher, 201, pages 93-260. Springer-Verlag, 1979.
- [301] H. Rüssmann. On the existence of invariant curves of twist mappings of an annulus. In J. Palis, editor, *Geometric Dynamics* (Proceedings of the *International Symposium on Dynamical Systems*, Rio de Janeiro, 1981), *Lect. Notes Math.*, Vol. 1007, pages 677-718. Springer-Verlag, 1983.
- [302] H. Rüssmann. Non-degeneracy in the perturbation theory of integrable dynamical systems. In M.M. Dodson and J.A.G. Vickers, editors, *Number Theory and Dynamical Systems*, London Math. Soc. *Lect. Note Ser.*, Vol. 134, pages 5-18. Cambridge Univ. Press, 1989.
- [303] H. Rüssmann. Nondegeneracy in the perturbation theory of integrable dynamical systems. In S. Albeverio, Ph. Blanchard, and D. Testard, editors, *Stochastics, Algebra and Analysis in Classical and Quantum Dynamics*, *Math. and its Appl.*, Vol. 59, pages 211-223. Kluwer Academic, Dordrecht, 1990.
- [304] H. Rüssmann. On twist-Hamiltonians. *Talk held on the Colloque international: Mécanique céleste et systèmes hamiltoniens* (Marseille), 1990.
- [305] H. Rüssmann. On the frequencies of quasi periodic solutions of analytic nearly integrable Hamiltonian systems. In S.B. Kuksin, V.F. Lazutkin, and J. Pöschel, editors, *Seminar on Dynamical Systems* (St. Petersburg, 1991), pages 160-183. Birkhäuser, Basel, 1994.

- [306] D. Salamon. The Kolmogorov–Arnol’d–Moser theorem. ETH–Zürich, 1986 (preprint).
- [307] D. Salamon and E. Zehnder. KAM theory in configuration space. *Comment. Math. Helvetici*, 64(1): 84–132, 1989.
- [308] A.M. Samoilenko. *Elements of the Mathematical Theory of Multi-Frequency Oscillations*. Math. and its Appl., Vol. 71. Kluwer Academic, Dordrecht, 1991. [Russian original: Nauka, Moscow, 1987].
- [309] V.S. Samovol. Linearization of systems of differential equations in a neighborhood of invariant toroidal manifolds. *Trans. Moscow Math. Soc.*, 38: 183–215, 1980.
- [310] J. Scheurle. Bifurcation of a stationary solution of a dynamical system into n -dimensional tori of quasiperiodic solutions. In H.-O. Peitgen and H.-O. Walther, editors, *Functional Differential Equations and Approximation of Fixed Points*, Lect. Notes Math., Vol. 730, pages 442–454. Springer-Verlag, 1979.
- [311] J. Scheurle. Quasi-periodic solutions of the plane three-body problem near Euler’s orbits. *Celest. Mech.*, 28(1–2): 141–151, 1982.
- [312] J. Scheurle. Bifurcation of quasi-periodic solutions from equilibrium points of reversible dynamical systems. *Arch. Rat. Mech. Anal.*, 97(2): 103–139, 1987.
- [313] G.R. Sell. Bifurcation of higher dimensional tori. *Arch. Rat. Mech. Anal.*, 69(3): 199–230, 1979.
- [314] G.R. Sell. Smooth linearization near a fixed point. *Amer. J. Math.*, 107(5): 1035–1091, 1985.
- [315] M.B. Sevryuk. *Reversible Systems*. Lect. Notes Math., Vol. 1211. Springer-Verlag, 1986.
- [316] M.B. Sevryuk. On invariant tori of reversible systems in a neighborhood of an equilibrium point. *Russian Math. Surveys*, 42(4): 147–148, 1987.
- [317] M.B. Sevryuk. *Reversible dynamical systems*. PhD thesis, Moscow State University, 1987 [in Russian].
- [318] M.B. Sevryuk. Invariant m -tori of reversible systems with the phase space of dimension greater than $2m$. *J. Soviet Math.*, 51(3): 2374–2386, 1990. [Russian original: *Trudy Sem. im. I.G. Petrovskogo*, 14: 109–124, 1989].
- [319] M.B. Sevryuk. On the dimensions of invariant tori in the KAM theory. In V.V. Kozlov, editor, *Mathematical Methods in Mechanics*, pages 82–88. Moscow Univ. Press, 1990 [in Russian].
- [320] M.B. Sevryuk. Lower-dimensional tori in reversible systems. *Chaos*, 1(2): 160–167, 1991.
- [321] M.B. Sevryuk. Linear reversible systems and their versal deformations. *J. Soviet Math.*, 60(5): 1663–1680, 1992. [Russian original: *Trudy Sem. im. I.G. Petrovskogo*, 15: 33–54, 1991].

- [322] M.B. Sevryuk. Invariant tori of reversible systems in the presence of additional even coordinates. *Russ. Acad. Sci. Dokl. Math.*, 46(2): 286–289, 1993.
- [323] M.B. Sevryuk. Invariant tori of reversible systems of intermediate dimensions. *Russ. Acad. Sci. Dokl. Math.*, 47(1): 129–133, 1993. [Corrigenda (in Russian): *Dokl. Akad. Nauk*, 346(4): 576, 1996].
- [324] M.B. Sevryuk. New cases of quasiperiodic motions in reversible systems. *Chaos*, 3(2): 211–214, 1993.
- [325] M.B. Sevryuk. New results in the reversible KAM theory. In S.B. Kuksin, V.F. Lazutkin, and J. Pöschel, editors, *Seminar on Dynamical Systems* (St. Petersburg, 1991), pages 184–199. Birkhäuser, Basel, 1994.
- [326] M.B. Sevryuk. The iteration-approximation decoupling in the reversible KAM theory. *Chaos*, 5(3): 552–565, 1995.
- [327] M.B. Sevryuk. KAM-stable Hamiltonians. *J. Dynam. Control Syst.*, 1(3): 351–366, 1995.
- [328] M.B. Sevryuk. Some problems of the KAM theory: quasi-periodic motions in typical systems. *Russian Math. Surveys*, 50(2): 341–353, 1995.
- [329] M.B. Sevryuk. Invariant tori of Hamiltonian systems nondegenerate in the sense of Rüssmann. *Dokl. Akad. Nauk*, 346(5): 590–593, 1996 [in Russian, to be translated into English in *Russ. Acad. Sci. Dokl. Math.*].
- [330] M.B. Sevryuk. Excitation of elliptic normal modes of invariant tori in Hamiltonian systems. 1996 (*preprint*).
- [331] M.B. Sevryuk. The lack-of-parameters problem in the KAM theory revisited. In C. Simó, editor, *Hamiltonian Systems with Three or More Degrees of Freedom* (S'Agaró, Spain, 1995), NATO ASI Series C: Math. Physics. Kluwer Academic, Dordrecht, 1996 (*to appear*).
- [332] M.B. Sevryuk and A. Lahiri. Bifurcations of families of invariant curves in four-dimensional reversible mappings. *Phys. Lett. A*, 154(3–4): 104–110, 1991.
- [333] Ch.-W. Shih. Normal forms and versal deformations of linear involutive dynamical systems. *Chinese J. Math.*, 21(4): 333–347, 1993.
- [334] C.L. Siegel. Über die Existenz einer Normalform analytischer HAMILTONScher Differentialgleichungen in der Nähe einer Gleichgewichtslösung. *Math. Ann.*, 128(2): 144–170, 1954.
- [335] C.L. Siegel and J.K. Moser. *Lectures on Celestial Mechanics*. Springer-Verlag, 1971.
- [336] J. Sotomayor. Generic bifurcations of dynamical systems. In M.M. Peixoto, editor, *Dynamical Systems*, pages 561–582. Acad. Press, 1973.
- [337] V.G. Sprindžuk. *Metric Theory of Diophantine Approximations*. John Wiley, New York, 1979. [Russian original: Nauka, Moscow, 1977].

- [338] E.M. Stein. *Singular Integrals and Differentiability Properties of Functions*. Princeton Math. Series, No. 30. Princeton Univ. Press, 1970.
- [339] J.J. Stoker. *Nonlinear Vibrations in Mechanical and Electrical Systems*. John Wiley, New York, 1950 [reprinted: 1992].
- [340] N.V. Svanidze. Small perturbations of an integrable dynamical system with an integral invariant. *Proc. Steklov Inst. Math.*, 2: 127–151, 1981.
- [341] F. Takens. Singularities of vector fields. *Publ. Math. I.H.E.S.*, 43: 47–100, 1974.
- [342] D.V. Treshchëv. A mechanism for the destruction of resonant tori in Hamiltonian systems. *Math. USSR Sbornik*, 68(1): 181–203, 1991.
- [343] D.V. Treshchëv. Hyperbolic tori and asymptotic surfaces in Hamiltonian systems. *Russian J. Math. Phys.*, 2(1): 93–110, 1994.
- [344] J.-C. van der Meer. *The Hamiltonian Hopf Bifurcation*. Lect. Notes Math., Vol. 1160. Springer-Verlag, 1985.
- [345] J.-C. van der Meer. Bifurcation at nonsemisimple $1 : -1$ resonance. *Z. Angew. Math. Phys.*, 37(3): 425–437, 1986.
- [346] J.-C. van der Meer. Hamiltonian Hopf bifurcation with symmetry. *Nonlinearity*, 3(4): 1041–1056, 1990.
- [347] S.J. van Strien. Center manifolds are not C^∞ . *Math. Z.*, 166(2): 143–145, 1979.
- [348] A. Vanderbauwhede. Families of periodic solutions for autonomous systems. In A.R. Bednarek and L. Cesari, editors, *Dynamical Systems, Part II*, pages 427–446. Acad. Press, 1982.
- [349] A. Vanderbauwhede. *Local Bifurcation and Symmetry*. Research Notes Math., Vol. 75. Pitman, Boston, 1982.
- [350] A. Vanderbauwhede. Hopf bifurcation for equivariant conservative and time-reversible systems. *Proc. Roy. Soc. Edinburgh, Ser. A*, 116(1–2): 103–128, 1990.
- [351] P. Veerman and P. Holmes. The existence of arbitrarily many distinct periodic orbits in a two degree of freedom Hamiltonian system. *Physica D*, 14(2): 177–192, 1985.
- [352] F.O.O. Wagener. Quasi-periodic stability of invariant circles of an unfolded skew Hopf bifurcation (*in preparation*).
- [353] Y.-H. Wan. Versal deformations of infinitesimally symplectic transformations with antisymplectic involutions. In M. Roberts and I. Stewart, editors, *Singularity Theory and its Applications, Part II*, Lect. Notes Math., Vol. 1463, pages 301–320. Springer-Verlag, 1991.
- [354] A. Weinstein. *Lectures on Symplectic Manifolds*. Regional Conf. Ser. Math., no. 29. Amer. Math. Soc., Providence, RI, 1977 [2nd printing: 1979].

- [355] H. Whitney. Analytic extensions of differentiable functions defined in closed sets. *Trans. Amer. Math. Soc.*, 36(1): 63–89, 1934.
- [356] S. Wiggins. *Normally Hyperbolic Invariant Manifolds in Dynamical Systems*. Springer-Verlag, 1994.
- [357] B.P. Wood, A.J. Lichtenberg, and M.A. Lieberman. Arnol'd and Arnol'd-like diffusion in many dimensions. *Physica D*, 71(1–2): 132–145, 1994.
- [358] Zh. Xia. Existence of invariant tori in volume-preserving diffeomorphisms. *Ergod. Th. and Dynam. Syst.*, 12(3): 621–631, 1992.
- [359] Zh. Xia. Existence of invariant tori for certain non-symplectic diffeomorphisms. In H.S. Dumas, K.R. Meyer, and D.S. Schmidt, editors, *Hamiltonian Dynamical Systems: History, Theory, and Applications* (Cincinnati, 1992), The IMA Volumes in Math. and Appl., Vol. 63, pages 373–385. Springer-Verlag, 1995.
- [360] J. Xu, J. You, and Q. Qiu. Invariant tori for nearly integrable Hamiltonian systems with degeneracy. ETH-Zürich, 1994 (*preprint*). [A revised and abridged version of this preprint has been submitted to *Math. Z.*].
- [361] J.-C. Yoccoz. Travaux de Herman sur les tores invariants. In *Séminaire Bourbaki*, Vol. 754, 1991–92, pages 311–344. Astérisque, 206, 1992.
- [362] G.M. Zaslavskii and R.Z. Sagdeev. *Introduction to Nonlinear Physics. From the Pendulum to Turbulence and Chaos*. Nauka, Moscow, 1988 [in Russian. The English version: R.Z. Sagdeev, D.A. Usikov, and G.M. Zaslavsky. *Nonlinear Physics: From the Pendulum to Turbulence and Chaos*. Contemporary Concepts in Physics, Vol. 4. Harwood Academic Publ., 1988].
- [363] E. Zehnder. An implicit function theorem for small divisor problems. *Bull. Amer. Math. Soc.*, 80(1): 174–179, 1974.
- [364] E. Zehnder. Generalized implicit function theorems with applications to some small divisor problems, I and II. *Comm. Pure Appl. Math.*, 28(1): 91–140, 1975 and 29(1): 49–111, 1976.

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