

## References

- [1] D. V. Alekseevskij, V. V. Lychagin and A. M. Vinogradov, *Basic Ideas and Concepts of Differential Geometry, Geometry* vol. I. (Berlin: Springer–Verlag, 1991), pp. 1–264.
- [2] J. S. Allen, J. A. Barth and P. A. Newberger, On intermediate models for barotropic continental shelf and slope flowfields. Part I: formulation and comparison of exact solutions. *Phys. Oceanogr.* **20** (1990), 1017–1042.
- [3] E. Artin, *Geometric Algebra*. (New York: John Wiley & Sons, Inc., 1988).
- [4] B. Banos, Nondegenerate Monge–Ampère structures in dimension 3. *Lett. Math. Phys.* **62**:1 (2002), 1–15.
- [5] B. Banos, On symplectic classification of effective 3-forms and Monge–Ampère equations. *Differ. Geom. Appl.* **19**:2 (2003), 147–166.
- [6] N. Belotelov and A. Lobanov, Migration and demographic processes. In *Non-linear Diffusion, Proceeding of Mathematics, Computer, Education, International Conference*. (Moscow: Dubna, 1999), pp. 434–443.
- [7] L. Bers, *Mathematical Aspects of Subsonic and Transonic Gas Dynamics*. (New York: John Wiley & Sons, Inc., 1958).
- [8] A. V. Bitsadze, *Some Classes of Partial Differential Equations*. (Moscow: Nauka, 1981).
- [9] E. Bonan, Decomposition of the exterior algebra of hyper-Kähler manifolds. *C. R. Acad. Sci. Paris, Math.* **320**:4. (1995), 457–462.
- [10] W. M. Boothby and H. C. Wang, On contact manifolds. *Ann. Math.* **2**:68 (1958), 721–734.
- [11] M. Born and L. Infeld, Foundation of a new field theory. *Proc. R. Soc.* **144** (1934), 425–451.
- [12] N. E. Byers, Noether’s discovery of the deep connection between symmetries and conservation laws. In *The Heritage of Emmy Noether*. (RamatGan, 1996), pp. 67–81.
- [13] G. R. Cavalcanti and M. Gualtieri Generalized complex structures on nilmanifolds. *J. Symplectic Geom.* **2**:3 (2004), 393–410.
- [14] S. A. Chaplygin, Gas jets. *Uch. Zap. Mosk. Univ., Otdel. Fiz.-Mat. Nauk* **21** (1904).
- [15] S. Chynoweth and M. J. Sewell, Dual variables in semi-geostrophic theory. *Proc. R. Soc. Lond. A* **424** (1989), 155–186.

- [16] S. Chynoweth and M. J. Sewel, A concise derivation of the semi-geostrophic equations. *Q. J. R. Meteorol. Soc.* **117** (1991), 1109–1128.
- [17] M. J. P. Cullen, J. Norbury and R. J. Purser, Generalised Lagrangian solutions for atmospheric and oceanic flows. *Siam J. Appl. Math.* **51** (1991), 20–31.
- [18] M. J. P. Cullen and R. J. Purser, An extended Lagrangian theory of semi-geostrophic frontogenesis. *J. Atmos. Sci.* **41** (1984), 1477–1497.
- [19] G. A. Desroziers, Coordinate change for data assimilation in spherical geometry of frontal structures. *Mon. Wea. Rev.* **125** (1997), 3030–3038.
- [20] V. A. Dorodnitsin, Group properties and invariant solutions of non-linear thermal conductivity equations with source or drain, Preprint No 57 of Applied Mathematics Institute of the Academy of Sciences of the USSR (1979).
- [21] B. Doubrov and A. Kushner, *The Morimoto Problem, Geometry in Partial Differential Equations*. (River Edge, NJ: World Scientific Publishing, 1994), pp. 91–99.
- [22] S. V. Duzhin and V. V. Lychagin, Symmetries of distributions and quadrature of ordinary differential equations. *Acta Appl. Math.* **24**:1 (1991), 29–57.
- [23] F. J. Ernst, Black holes in a magnetic universe. *J. Math. Phys.* **17** (1976), 54–56.
- [24] D. S. Freed, Special Kähler manifolds. *Commun. Math. Phys.* **203** (1999), 31–52.
- [25] O.-K. Fossum, On classification of a system of non-linear first-order PDEs of Jacobi type, Preprint Tromsö University (2002).
- [26] A. Frölicher and A. Nijenhuis, Theory of vector valued differential forms. Part 1: derivations in the graded ring of differential forms. *Indag. Math.* **18** (1956), 338–359.
- [27] Gibbons J., Tsarev S. P., Reduction of the Benney equations, *Phys. Lett. A* **211** (1996), 19–24.
- [28] H. Goldschmidt, Formal integrability criteria for systems of non-linear partial differential equations *J. Differ. Geom.* **1** (1967), 269–307.
- [29] E. Goursat, *Leçon sur l'intégration des Équations aux Dérivée Partielles du Second Ordre a Deux Variables Indépendantes*, vol. 1 (Paris, 1896).
- [30] E. Goursat, Sur le problème de Monge. *Bull. Soc. Math. France* **33** (1905), 201–210.
- [31] E. Goursat, Sur les équations du second ordre à  $n$  variables analogues à l'équation de Monge–Ampère. *Bull. Soc. Math. France* **27** (1899), 1–34.
- [32] M. Gross, Special Lagrangian fibrations II: geometry. *Surv. Differ. Geom.* **5** (1999), 341–403.
- [33] D. I. Gurevich, V. V. Lychagin and V. N. Roubtsov, Cohomologie de “grand crochet” et filtration “non-holonomie.” *C. R. Acad. Sci. Paris Sr. I Math.* **313**:12 (1991), 855–858.
- [34] D. I. Gurevich, V. V. Lychagin and Roubtsov V. N., Nonholonomic filtration of the cohomology of Lie algebras and “large brackets.” *Mat. Zametki* **52**:1 (1992), 36–41.
- [35] G. Hart, *Geometric Quantization in Action: Applications of Harmonic Analysis in Quantum Statistical Mechanics and Quantum Field Theory*. (Dordrecht: Reidel Publishing, 1983).
- [36] N. J. Hitchin, *Monopoles, Minimal Surfaces and Algebraic Curves, NATO Advanced Study Institute* vol. 105 (1987).

- [37] N. J. Hitchin, The moduli space of special Lagrangian submanifolds. *Ann. Scuola Norm. Sup. Pisa Cl. Sci.* **25** (1997), 503–515.
- [38] N. J. Hitchin, The geometry of three-forms in six dimensions. *Differ. Geom.* **55**:3 (2000), 547–576.
- [39] J. K. Hunter and R. Saxton, Dynamics of director fields. *SIAM J. Appl. Math.* **51**:6 (1991), 1498–1521.
- [40] Igusa, Jun-ichi, A classification of spinors up to dimension twelve. *Amer. J. Math.* **92** (1970), 997–1028.
- [41] P. Jakobsen, V. Lychagin and Y. Romanovsky, Symmetries and non-linear phenomena, I. Preprint, Tromsø University (1997).
- [42] P. Jakobsen, V. Lychagin and Y. Romanovsky, Symmetries and non linear phenomena, II, applications to non-linear acoustics. Preprint, Tromsø University (1998).
- [43] K. Jörgens, Differentialgleichung  $rt - s^2 = 1$ . *Math. Ann.* **127** (1954), 130–134.
- [44] T. Karman, The similarity law of transonic flow. *Math. Phys.* **26** (1947), 182–190.
- [45] Kazuhiko Aomoto and Toru Tsujishita, Open problems in structure theory of non-linear integrable differential and difference systems. (Nagoya University, 1984), p. 44.
- [46] M. V. Keldysh, Cases of degeneracy of equations of elliptic type on the boundary of a domain. *Dokl. Akad. Nauk SSSR* **77**:2 (1951), 181–183.
- [47] A. A. Kirillov, *Geometric Quantization*, vol. 4. (2001), 139–176.
- [48] A. N. Kolmogorov, I. G. Petrovsky and I. S. Piskunov. Examining of diffusion equation with increasing of substance amount, and its application to one biological problem. *MSU Bull. A* **6** (1937), 1–26.
- [49] I. B. Kovalenko and A. G. Kushner, The non-linear diffusion and thermal conductivity equation: group classification and exact solutions. *Regular Chaotic Dynam.* **8**:2 (2003), 8–31.
- [50] I. S. Krasilshchik, V. V. Lychagin and A. M. Vinogradov, *Geometry of Jet Spaces and Non-linear Partial Differential Equations*. (New York: Gordon and Breach, 1986).
- [51] I. S. Krasilshchik, Some new cohomological invariants for non-linear differential equations. *Differ. Geom. Appl.* **2**:4 (1992), 307–350.
- [52] B. S. Kruglikov, Nijenhuis tensors and obstructions to the construction of pseudoholomorphic mappings. *Mat. Zametki* **63**:4 (1998), 541–561.
- [53] B. S. Kruglikov, On some classification problems in four-dimensional geometry: distributions, almost complex structures, and the generalized Monge–Ampère equations. *Mat. Sb.* **189**:11 (1998), 61–74.
- [54] B. S. Kruglikov, Symplectic and contact Lie algebras with application to the Monge–Ampère equations. *Tr. Mat. Inst. Steklova* **221** (1998), 232–246.
- [55] B. S. Kruglikov, Classification of Monge–Ampère equations with two variables. *CAUSTICS '98, Warsaw*. (Warsaw: Polish Academy of Sciences, 1999), pp. 179–194.
- [56] B. S. Kruglikov and V. V. Lychagin, On equivalence of differential equations. *Acta Comment. Univ. Tartu. Math.* (1999), 7–29.
- [57] B. S. Kruglikov and V. V. Lychagin, Mayer brackets and solvability of PDEs, I. *Differ. Geom. Appl.* **17**:2–3 (2002), 251–272.

- [58] A. Kushner, Chaplygin and Keldysh normal forms of Monge–Ampère equations of variable type. *Math. Zametki* **52**:5 (1992), 63–67.
- [59] A. Kushner, Classification of mixed type Monge–Ampère equations. *Geometry in Partial Differential Equations*. (1993) pp. 173–188.
- [60] A. Kushner, Symplectic geometry of mixed type equations. *Amer. Math. Soc. Transl. Ser. 2* (1995), 131–142.
- [61] A. Kushner, Monge–Ampère equations and e-structures. *Dokl. Akad. Nauk* **361**:5 (1998), 595–596.
- [62] A. Kushner, Contact linearization of nondegenerate Monge–Ampère equations. *Natural Sci.*
- [63] I. B. Kovalenko and A. G. Kushner, Symmetries and exact solutions of non-linear diffusion equation. *Math. Model. Comput. Biol. Medicine*. July (2002), 239.
- [64] N. Larkin, B. Novikov and N. Yanenko, *Non-Linear Mixed Type Equations*. (Novosibirsk: Nauka, 1983).
- [65] S. Lie, Classification und integration von gewöhnlichen Differentialgleichungen zwischen  $x, y$ , die eine Gruppe von Transformationen gestatten. *Math. Ann.* **32** (1888), 213–281.
- [66] S. Lie, Begründung einer Invarianten-Theorie der Berührungs-Transformationen. *Math. Ann.* **8** (1874), 215–303.
- [67] S. Lie Über einige partielle Differential-Gleichungen zweiter Ordnung. *Math. Ann.* **5** (1872), 209–256.
- [68] V. Lychagin and O. Lychagina, Finite dimensional dynamics for evolutionary equations. *Nonlin. Dynam.* (2006), to appear.
- [69] V. V. Lychagin, Contact geometry and second-order non-linear differential equations. *Russian Math.* **34** (1979), 137–165.
- [70] V. V. Lychagin, Singularities of multivalued solutions of non-linear differential equations and non-linear phenomena. *Acta Appl. Math.* **3** (1985), 135–173.
- [71] V. V. Lychagin, Differential equations on two-dimensional manifolds. *Izv. Vyssh. Uchebn. Zaved. Mat.* **5** (1992), 43–57.
- [72] V. Lychagin, *Lectures on Geometry of Differential Equations*, vols 1, 2. (Rome: La Sapienza, 1993).
- [73] V. V. Lychagin and V. N. Roubtsov, On Sophus Lie theorems for Monge–Ampère equations. *Dokl. Akad. Nauk BSSR* **27**:5 (1983), 396–398.
- [74] V. V. Lychagin and V. N. Roubtsov, Local classification of Monge–Ampère differential equations. *Dokl. Akad. Nauk SSSR* **272**:1 (1983), 34–38.
- [75] V. V. Lychagin and V. N. Roubtsov, Non-holonomic filtration: algebraic and geometric aspects of non-integrability. In *Geometry in Partial Differential Equations*. (River Edge, NJ: World Scientific Publishing, 1994).
- [76] V. V. Lychagin and R. Romanovsky Yu., Nonholonomic intermediate integrals of partial differential equations. In *Differential Geometry and its Applications* (Brno, 1989). (Teaneck, NJ: World Scientific Publishing, 1990).
- [77] V. V. Lychagin, V. N. Roubtsov and I. V. Chekalov, A classification of Monge–Ampère equations. *Ann. Sci. Ecole Norm. Sup.(4)* **26**:3 (1993), 281–308.
- [78] L. J. Mason and N. M. J. Woodhouse, *Integrability, Self-duality, and Twistor Theory*, *London Mathematical Society Monographs, New Series*, vol. 15. (New York: Oxford University Press, 1996).

- [79] M. Matsuda, Two methods of integrating Monge–Ampère equations I. *Trans. Amer. Math. Soc.* **150**:1 (1970), 327–343.
- [80] J. C. McWilliams and P. R. Gent, Intermediate models of planetary circulations in the atmosphere and ocean. *J. Atmos. Sci.* **37** (1980), 1657–1678.
- [81] M. E. McIntyre and I. Roulstone, Hamiltonian balanced models: constraints, slow manifolds and velocity splitting. *Forecasting Research Scientific Paper* 41 (1996), <http://www.atm.damtp.cam.ac.uk/people/mem/>
- [82] M. E. McIntyre and I. Roulstone, Are there higher-accuracy analogues of semi-geostrophic theory? *Large Scale Atmosphere–Ocean Dynamics*, vol. II, *Geometric Methods and Models*, ed. I. Roulstone and J. Norbury. (Cambridge: Cambridge University Press), to appear.
- [83] T. Morimoto, La géométrie des équations de Monge–Ampère. *C. R. Acad. Sci. Paris A-B* **289**:1 (1979), A25–A28.
- [84] T. Morimoto, Open problem in str. theory of non-linear integrable differential and difference systems. *The 15 International Symposium, Katata.* (1984), pp. 27–29.
- [85] O. I. Morozov, Contact equivalence problem for non-linear wave equations. Preprint arXiv: math-ph/0306007 v.1 (2003), pp. 1–13.
- [86] O. I. Morozov, Contact equivalence of the generalized Hunter–Saxton equation and the Euler–Poisson equation. Preprint arXiv: math-ph/0406016 (2004), pp. 1–3.
- [87] J. D. Murray, *Mathematical Biology*. (Berlin: Springer-Verag, 1993).
- [88] A. Newlander and L. Nirenberg, Complex analytic coordinates in almost complex manifolds. *Ann. Math.* **65** (1954), 391–404.
- [89] J. Nielsen, On the intermediate integral for Monge–Ampère equations. *Proc. Amer. Math. Soc.* **128**:2 (2000), 527–531.
- [90] V. L. Popov, A classification of spinors of dimension fourteen. *Trudy Moskov. Mat. Obshch.* **37** (1978), 173–217.
- [91] R. J. Purser, Contact transformations and Hamiltonian dynamics in generalized semi-geostrophic theories. *J. Atmos. Sci.* **50** (1993), 1449–1468.
- [92] R. J. Purser and M. J. P. Cullen, A duality principle in semi-geostrophic theory. *J. Atmos. Sci.* **44** (1987), 3449–3468.
- [93] B. L. Rojdestvensky and N. N. Yanenko, *Systems of Quasilinear Equations and their Applications to Gas Dynamics*. (Moscow: Nauka, 1968).
- [94] V. N. Roubtsov and I. Roulstone, Examples of quaternionic and Kähler structures in Hamiltonian models of nearly geostrophic flow. *J. Phys. A* **30**:4 (1997), L63–L68.
- [95] Roubtsov V. N. and I. Roulstone, Holomorphic structures in hydrodynamical models of nearly geostrophic flow. *R. Soc. Lond. Proc. A* **457** (2001), 1519–1531.
- [96] I. Roulstone and J. Norbury, A Hamiltonian structure with contact geometry for the semi-geostrophic equations. *J. Fluid Mech.* **272** (1994), 211–233.
- [97] I. Roulstone and M. J. Sewell, The mathematical structure of theories of semi-geostrophic type. *Phil. Trans. R. Soc. Lond.* **355** (1997), 2489–2517.
- [98] O. V. Rudenko and S. I. Soluyan, *Theoretical Foundations of Non-linear Acoustics*, transl. from Russian by R. T. Beyer, *Studies in Soviet Science*. (New York: Consultants Bureau, 1997).

- [99] A. A. Samarsky, S. P. Kurdyumov, V. A. Galaktionov and Michailov A. P., *Peaking Regimes in Problem for Quasilinear Parabolic Equations* (Moscow: Nauka, 1987).
- [100] W. Słebodziński, *Exterior Forms and their Applications*. (Warsaw: PWN-Polish Scientific Publishers, 1970).
- [101] R. Salmon, Practical use of Hamilton's principle. *J. Fluid Mech.* **132** (1983), 431–444.
- [102] R. Salmon, New equations for nearly geostrophic flow. *J. Fluid Mech.* **153** (1985), 461–477.
- [103] R. Salmon, Semi-geostrophic theory as a Dirac bracket projection. *J. Fluid Mech.* **196** (1988), 345–358.
- [104] M. J. Sewell and I. Roulstone, Families of lift and contact transformations. *Proc. R. Soc. Lond.* **447** (1994), 493–512.
- [105] D. V. Tunitskii, Contact equivalence of Monge–Ampère equations with transitive symmetries. In *Differential Geometry and Applications*, Brno. (1995), pp. 479–485.
- [106] D. V. Tunitskii, On the contact linearization of Monge–Ampère equations. *Izv. Ross. Akad. Nauk Ser. Mat.* **60**:2 (1996), 195–220.
- [107] D. V. Tunitskii, Monge–Ampère equations and characteristic connection functors. *Izv. Ross. Akad. Nauk Ser. Mat.* **65**:6 (2001), 173–222.
- [108] F. Tricomi, Sulle equazioni lineari alle derivate parziali di secondo ordine di tipo misto. *Rend. Atti Acad. Nazion. Lincei* **5**:14 (1923), 134–247.
- [109] B. Trubnikov and S. Zhdanov, *Quasi-Gaseous Unstable Media*. (Moscow: Nauka, 1991).
- [110] C. Udriste and N. Bila, Symmetry group of Titeica surfaces, PDE. *Balkan J. Geom. Applic.* **4**:2 (1999), 123–140.
- [111] G. B. Whitham, *Linear and Non-linear Waves*. (New York: Wiley-Interscience, 1974).
- [112] V. F. Zaitsev and A. D. Polyanin, *Non-Linear Partial Differential Equations, Handbook: Exact Solutions*. (Moscow: Nauka, 1996).
- [113] L. V. Zilbergleit, Second-order differential equation associated with contact geometry: symmetries, conservation laws and shock waves. *Acta Appl. Math.* **45**:1 (1996), 51–71.
- [114] L. V. Zilbergleit, Geometry of the Hugoniot–Rankine conditions. *Russ. J. Math. Phys.* **7**:2 (2000), 234–249.