

# Bibliography

- [Armi 1989] L. Armi, D. Hebert, N. Oakey, J. F. Price, P. L. Richardson, H. T. Rossby, and B. Ruddick, Two Years in the Life of a Mediterranean Salt Lens, *Journal of Physical Oceanography*, 19(3), 354–370 (1989).
- [Arnold 1978] Arnold, V. I. (1978). *Mathematical Methods of Classical Dynamics*. Springer-Verlag.
- [Aurell 1997] E. Aurell, G. Boffetta, A. Crisanti, G. Paladin, and A. Vulpiani, Predictability in the large: an extension of the concept of Lyapunov exponent, *Journal of Physics A: Mathematical and General*, 30(1), 1-26 (1997).
- [Barrio 2006] R. Barrio, Sensitivity Analysis of ODES/DAES Using the Taylor Series Method, *SIAM J. Sci. Comput.*, 27(6), 1929–1947 (2006).
- [Barrow-Green 1996] Barrow-Green, J. (1996). *Poincaré and the Three Body Problem*. American Mathematical Society.
- [Beigie 1991] D. Beigie, A. Leonard, and S. Wiggins, Chaotic transport in the homoclinic and heteroclinic tangle regions of quasiperiodically forced two-dimensional dynamical systems, *Nonlinearity*, 4(3), 775–819 (1991).
- [Bhattacharjee 2000] S. M. Bhattacharjee, Unzipping DNAs: towards the first step of replication, *Journal of Physics A: Mathematical and General*, 33(45), L423-L428 (2000).
- [Booker 1999] A. J. Booker, J. E. Dennis, P. D. Frank, D. B. Serafini, V. Torczon, and M. W. Trosset, A rigorous framework for optimization of expensive functions by surrogates, *Structural and Multidisciplinary Optimization*, 17(1), 1–13 (1999).

- [Brunger 1984] A. Brunger, C. L. Brooks, and M. Karplus, Stochastic boundary conditions for molecular dynamics simulations of ST2 water, *Chemical Physics Letters*, 105(5), 495–500 (1984).
- [Bryan 2008] F. O. Bryan, Introduction: Ocean modeling – eddy or not, appearing in *Ocean modeling in an eddying regime* M. Hecht, H. Hasumi, (eds.) American Geophysical Union, 1-3 (2008).
- [Campbell 2005] D. K. Campbell, P. Rosenau, and G. M. Zaslavsky, Introduction: The Fermi–Pasta–Ulam problem—The first fifty years, *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 15(1), 015101 (2005).
- [Cartwright 1945] M. L. Cartwright and J. E. Littlewood, On Non-Linear Differential Equations of the Second Order: I. the Equation  $\ddot{y} + y = b\lambda^k \cos(\lambda t + \alpha)$ ,  $k$  Large, *Journal of the London Mathematical Society*, s1-20(3), 180–189 (1945/6/1).
- [Causo 2000] M. S. Causo, B. Coluzzi, and P. Grassberger, Simple model for the DNA denaturation transition, *Phys. Rev. E*, 62(3), 3958–3973 (2000).
- [Chandrasekhar 1969] Chandrasekhar, S. (1969). *Ellipsoidal Figures of Equilibrium*. Dover.
- [Chelton 2007] D. B. Chelton, M. G. Schlax, R. M. Samelson, and R. A. de Szoeke, Global observations of large oceanic eddies, *Geophys. Res. Lett.*, 34 (2007).
- [Chen 2007] Chen, S. S., J. F. Price, W. Zhao, M. A. Donelan, and E. J. Walsh [2007], The CBLAST-Hurricane Program and the next-generation fully coupled atmosphere-wave-ocean models for hurricane research and prediction. *Bull. Amer. Meteor. Soc.*, **88**, 311–317.
- [Chertock 2009] A. Chertock, P. Du Toit, and J. Marsden, A particle method for the EPdiff equation, Article in preparation.

- [Cocco 1999] S. Cocco and R. Monasson, Statistical Mechanics of Torque Induced Denaturation of DNA, *Physics Review Letters*, 83, 5178–5181 (1999).
- [Dauxois 1993] T. Dauxois, M. Peyrard, and A. R. Bishop, Entropy-driven DNA denaturation, *Phys. Rev. E*, 47(1), R44–R47 (1993).
- [Dauxois 2008] T. Dauxois, Fermi, Pasta, Ulam and a mysterious lady, *PHYSICS TODAY*, 61, 55 (2008).
- [d’Ovidio 2004] F. d’Ovidio, V. Fernández, E. Hernández-Garca, and C. López, Mixing structures in the Mediterranean Sea from finite-size Lyapunov exponents, *Geophys. Res. Lett.*, 31 (2004).
- [Drevillon 2008] M. Drvillon, The GODAE/Mercator-Ocean global ocean forecasting system: results, applications and prospects, *Journal of Operational Oceanography*, 1(1), 51-57 (2008).
- [Du Toit 2009a] P. Du Toit, I. Mezic, and J. Marsden, Coupled oscillator models with no scale separation, *Physica D: Nonlinear Phenomena*, 238(5), 490-501 (2009).
- [Du Toit 2009b] P. Du Toit, K. Grubits, S. Costiner, and J.E. Marsden, Fast generation of potentials for self-assembly, Submitted.
- [Du Toit 2009c] P. Du Toit, M. Kabilarov, S. Nair, and J. Marsden, A framework for search with under-actuated vehicles and uncertain sensors, In preparation.
- [Emanuel 2001] K. Emanuel, Contribution of tropical cyclones to meridional heat transport by the oceans, *J. Geophys. Res.*, 106 (2001).
- [Emanuel 2007] K. Emanuel, Environmental Factors Affecting Tropical Cyclone Power Dissipation, *Journal of Climate*, 20(22), 5497–5509 (2007).
- [Ercolani 1990] N. Ercolani, M. G. Forest, D. W. McLaughlin, Geometry of the modulational instability III. Homoclinic orbits for the periodic sine-Gordon equation, *Physica D Nonlinear Phenomena* 43 (1990) 349-84

- [Fermi 1955] E. Fermi, J. Pasta, and S. Ulam, Studies of Nonlinear Problems. I, Los Alamos Report, (LA-1940) (1955).
- [Forest 1992] M. G. Forest, C. G. Goedde, A. Sinha, Instability-driven energy transport in near-integrable, many degrees-of-freedom, Hamiltonian systems, *Physical Review Letters* 68 (1992) 2722-5.
- [Fox-Kemper 2008] B. Fox-Kemper and D. Menemenlis, Can large eddy simulation techniques improve mesoscale rich ocean models?, appearing in *Ocean modeling in an eddying regime* M. Hecht, H. Hasumi, (eds.) American Geophysical Union, 319-337 (2008).
- [Franco 2007] E. Franco, D. Pekarek, J. Peng, and J. Dabiri, Geometry of unsteady fluid transport during fluid-structure interactions, *Journal of Fluid Mechanics*, 589(-1), 125-145 (2007).
- [Gawlik 2009] E. Gawlik, J. Marsden, P. Du Toit, and S. Campagnola, Lagrangian coherent structures in the planar elliptic restricted three-body problem, *Celestial Mechanics and Dynamical Astronomy*, 103(3), 227–249 (2009/03/01/).
- [Gent 1990] P. R. Gent and J. C. McWilliams, Isopycnal Mixing in Ocean Circulation Models, *Journal of Physical Oceanography*, 20(1), 150–155 (1990).
- [Guckenheimer 1983] J. Guckenheimer and P. Holmes. (1983). *Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields*. Springer.
- [Haller 2000] G. Haller and G. Yuan, Lagrangian coherent structures and mixing in two-dimensional turbulence, *Physica D: Nonlinear Phenomena*, 147(3-4), 352–370 (2000).
- [Haller 2001] G. Haller, Distinguished material surfaces and coherent structures in three-dimensional fluid flows, *Physica D: Nonlinear Phenomena*, 149(4), 248–277 (2001).

- [Haller 2002] G. Haller, Lagrangian coherent structures from approximate velocity data, *Physics of Fluids*, 14(6), 1851–1861 (2002).
- [Hecht 2008a] M. W. Hecht, D. D. Holm, M. R. Petersen, and B. A. Wingate, The LANS- $\alpha$ ; and Leray turbulence parameterizations in primitive equation ocean modeling, *Journal of Physics A: Mathematical and Theoretical*, 41(34), 344009 (23pp) (2008).
- [Hecht 2008b] M. W. Hecht, D. D. Holm, M. R. Petersen, and B. A. Wingate, Implementation of the LANS- $\alpha$  turbulence model in a primitive equation ocean model, *Journal of Computational Physics*, 227, 5691-5716 (2008).
- [Hill 1894] M. J. M. Hill, On a Spherical Vortex, *Philosophical Transactions of the Royal Society of London. A*, 185, 213–245 (1894).
- [Holm 2005] D. Holm and J. Marsden, Momentum maps and measure-valued solutions (peakons, filaments, and sheets) for the EPDiff equation, *The Breadth of Symplectic and Poisson Geometry*, , 203–235 (2005).
- [Holmes 1990] P. Holmes, Poincaré, *Celestial Mechanics, Dynamical-Systems Theory, and Chaos*, *Physics Reports*, 193(3), 137-163 (1990).
- [Houze 2007] J. Houze, Robert A., S. S. Chen, B. F. Smull, W. Lee, and M. M. Bell, Hurricane Intensity and Eyewall Replacement, *Science*, 315(5816), 1235–1239 (2007).
- [Ide 2002] K. Ide, D. Small, and S. Wiggins, Distinguished hyperbolic trajectories in time-dependent fluid flows: analytical and computational approach for velocity fields defined as data sets, *Nonlinear Processes in Geophysics*, 9(3/4), 237–263 (2002).
- [Kafri 2002] Y. Kafri, D. Mukamel, and L. Peliti, Melting and unzipping of DNA, *European Physical Journal B*, 27, 135 (2002).

- [Kida 1981] S. Kida, Motion of an elliptic vortex in a uniform shear flow, *Journal of the Physical Society of Japan*, 50, 3517-3520 (1981).
- [Kirchhoff 1876] G. R. Kirchhoff. *Vorlesungen uber Mathematische Physik*, Vol. I, Teubner, Leipzig, 1876.
- [Koon 2000] W. S. Koon, M. W. Lo, J. E. Marsden, and S. D. Ross, Heteroclinic connections between periodic orbits and resonance transitions in celestial mechanics, *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 10(2), 427-469 (2000).
- [Kuo 2003] Kuo, B., et al. Hurricane Isabel data produced by the Weather Research and Forecast (WRF) model, courtesy of NCAR, and the U.S. National Science Foundation (NSF).
- [Lamb 1945] Lamb, H. (1945). *Hydrodynamics*. Dover Publications.
- [Lekien 2003] F. Lekien, *Time-Dependent Dynamical Systems and Geophysical Flows*, PhD Thesis, (2003).
- [Lekien 2005] F. Lekien, C. Coulliette, A. J. Mariano, E. H. Ryan, L. K. Shay, G. Haller, and J. Marsden, Pollution release tied to invariant manifolds: A case study for the coast of Florida, *Physica D: Nonlinear Phenomena*, 210(1-2), 1–20 (2005).
- [Lekien 2007] F. Lekien, S. C. Shadden, and J. E. Marsden, Lagrangian coherent structures in n-dimensional systems, *Journal of Mathematical Physics*, 48(6), 065404 (2007).
- [Levinson 1949] N. Levinson, A Second Order Differential Equation with Singular Solutions, *The Annals of Mathematics*, 50(1), 127–153 (1949).
- [Li 2008] Z. Li, Y. Chao, J. C. McWilliams, and K. Ide, A three-dimensional variational data assimilation scheme for the Regional Ocean Modeling System: Implementation and basic experiments, *J. Geophys. Res.*, 113 (2008).

- [Mathur 2007] M. Mathur, G. Haller, T. Peacock, J. E. Ruppert-Felsot, and H. L. Swinney, Uncovering the Lagrangian Skeleton of Turbulence, *Physical Review Letters*, 98(14), 144502–4 (2007).
- [McKiver 2003] W. J. McKiver and D. G. Dritschel, The motion of a fluid ellipsoid in a general linear background flow, *Journal of Fluid Mechanics*, 474, 147-173 (2003).
- [McLachlan 1992] R. I. McLachlan and P. Atela, The accuracy of symplectic integrators, *Nonlinearity*, 5, 541–562 (1992).
- [Meacham 1994] S. P. Meacham, K. K. Pankratov, A. F. Shchepetkin, and V. V. Zhmur, The interaction of ellipsoidal vortices with background shear flows in a stratified fluid, *Dynamics of Atmospheres and Oceans*, 21(2-3), 167–212 (1994).
- [Mezic 2006] I. Mezic, On the dynamics of molecular conformation, *PNAS*, 103(20), 7542-7547 (2006).
- [Morton 1913] W. B. Morton, On the Displacements of the Particles and Their Paths in Some Cases of Two-Dimensional Motion of a Frictionless Liquid, *Royal Society of London Proceedings Series A*, 89, 106-124 (1913).
- [Odier 2007] P. Odier, Characterization of turbulent mixing in an Oceanic Overflow Facility, Abstract submitted to DFD07 Meeting of the American Physical Society, (2007).
- [Peng 2009] J. Peng and J. O. Dabiri, Transport of inertial particles by Lagrangian coherent structures: application to predator-prey interaction in jellyfish feeding, *Journal of Fluid Mechanics*, 623(-1), 75-84 (2009).
- [Peyrard 2004] M. Peyrard, Nonlinear dynamics and statistical physics of DNA, *Nonlinearity*, 17(2), R1-R40 (2004).
- [Poincaré 1899] Poincare, H. (1899). *New Methods of Celestial Mechanics*. Springer.

- [Polvani 1990] L. M. Polvani, J. Wisdom, E. DeJong, and A. P. Ingersoll, Simple Dynamical Models of Neptune’s Great Dark Spot, *Science*, 249(4975), 1393–1398 (1990).
- [Richardson 2007] M. I. Richardson, A. D. Toigo, and C. E. Newman, PlanetWRF: A general purpose, local to global numerical model for planetary atmospheric and climate dynamics, *J. Geophys. Res.*, 112 (2007).
- [Rom-Kedar 1990] V. Rom-Kedar, A. Leonard, and S. Wiggins, An analytical study of transport, mixing and chaos in an unsteady vortical flow, *Journal of Fluid Mechanics Digital Archive*, 214(-1), 347-394 (1990).
- [Rom-Kedar 1991] V. Rom-Kedar and S. Wiggins, Transport in two-dimensional maps: concepts, examples, and a comparison of the theory of Rom-Kedar and Wiggins with the Markov model of MacKay, Meiss, Ott, and Percival, *Phys. D*, 51(1-3), 248–266 (1991).
- [Sanders 2007] Sanders, J., Verhulst, F., and Murdock, J. (2007). *Averaging Methods in Nonlinear Dynamical Systems*. Springer.
- [Sapsis 2009] H. Sapsis, Inertial Particle Dynamics in a Hurricane, *Journal of the Atmospheric Sciences*, In press. (2009).
- [Schiermeier 2007] Q. Schiermeier, Oceanography: Churn, churn, churn, *Nature*, 447(7144), 522–524 (2007).
- [Shadden 2005] S. C. Shadden, F. Lekien, and J. E. Marsden, Definition and properties of Lagrangian coherent structures from finite-time Lyapunov exponents in two-dimensional aperiodic flows, *Physica D: Nonlinear Phenomena*, 212(3-4), 271–304 (2005).
- [Shadden 2007] S. C. Shadden, K. Katija, M. Rosenfeld, J. E. Marsden, and J. O. Dabiri, Transport and stirring induced by vortex formation, *Journal of Fluid Mechanics*, 593(-1), 315–331 (2007).



- [Shadden 2008] S. Shadden and C. Taylor, Characterization of Coherent Structures in the Cardiovascular System, *Annals of Biomedical Engineering*, 36(7), 1152–1162 (2008).
- [Smale 1967] S. Smale, Differentiable dynamical systems, *Bull. Amer. Math. Soc.*, 73, 747–817 (1967).
- [Smale 1998] S. Smale, Finding a horseshoe on the beaches of Rio, *Mathematical Intelligencer*, 20, 39-44 (1998).
- [Solomon 2007] *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- [Surana 2008] A. Surana, G. B. Jacobs, O. Grunberg, and G. Haller, An exact theory of three-dimensional fixed separation in unsteady flows, *Physics of Fluids*, 20(10), 107101-+ (2008).
- [Szebehely 1967] Szebehely, V. (1967). *Theory of Orbits, The restricted problem of three bodies..* Academic Press.
- [Szpiro 2007] Szpiro, G. (2007). *Poincaré's Prize*. Penguin.
- [Tallapragada 2008] P. Tallapragada and S. D. Ross, Particle segregation by Stokes number for small neutrally buoyant spheres in a fluid, *Physical Review E (Statistical, Nonlinear, and Soft Matter Physics)*, 78(3), 036308 (2008).
- [Tanaka 2008] M. Tanaka and S. Ross, Separatrices and basins of stability from time series data: an application to biodynamics, *Nonlinear Dynamics*, (2008).
- [Vellinga 2002] M. Vellinga and R. A. Wood, Global Climatic Impacts of a Collapse of the Atlantic Thermohaline Circulation, *Climatic Change*, 54(3), 251–267 (2002).

- [Verhulst 2000] Verhulst, F. (2000). *Nonlinear Differential Equations and Dynamical Systems*, 2<sup>nd</sup> Ed.. Springer.
- [Weber 2006] G. Weber, N. Haslam, N. Whiteford, A. Prugel-Bennett, J. Essex, and C. Neylon, Thermal equivalence of DNA duplexes without calculation of melting temperature, *Nature Physics*, 2, 55–59 (2006).
- [Weinkauff 2007] T. Weinkauff, J. Sahner, J. Sahner, H. Theisel, H. Theisel, and H. C. Hege, Cores of Swirling Particle Motion in Unsteady Flows, *Visualization and Computer Graphics*, IEEE Transactions on, 13(6), 1759–1766 (2007).
- [Weldon 2008] M. Weldon, T. Peacock, G. B. Jacobs, M. Helu, and G. Haller, Experimental and numerical investigation of the kinematic theory of unsteady separation, *Journal of Fluid Mechanics*, 611(-1), 1-11 (2008).
- [Whitesides 2002] G. M. Whitesides and B. Grzybowski, Self-Assembly at All Scales, *Science*, 295(5564), 2418–2421 (2002).
- [Wiggins 2003] Wiggins, S. (2003). *Introduction to Applied Nonlinear Dynamical Systems and Chaos* (Second Edition). Springer.
- [Yakushevich 2004] Yakushevich, L. (2004). *Nonlinear Physics of DNA*. Wiley-VCH.
- [Yanao 2007] T. Yanao, W. S. Koon, J. E. Marsden, and I. G. Kevrekidis, Gyration-radius dynamics in structural transitions of atomic clusters, *The Journal of Chemical Physics*, 126(12), 124102 (2007).