

# REFERENCES

- Abraham, R. H., and Shaw, C. D. (1983) *Dynamics: The Geometry of Behavior. Part 2: Chaotic Behavior* (Aerial Press, Santa Cruz, CA).
- Abraham, R. H., and Shaw, C. D. (1988) *Dynamics: The Geometry of Behavior. Part 4: Bifurcation Behavior* (Aerial Press, Santa Cruz, CA).
- Abrams, D. M., and Strogatz, S. H. (2003) Modelling the dynamics of language death. *Nature* **424**, 900.
- Ahlers, G. (1989) Experiments on bifurcations and one-dimensional patterns in nonlinear systems far from equilibrium. In D. L. Stein, ed. *Lectures in the Sciences of Complexity* (Addison-Wesley, Reading, MA).
- Aihara, I., Takeda, R., Mizumoto, T., Otsuka, T., Takahashi, T., Okuno, H. G., and Aihara, K. (2011) Complex and transitive synchronization in a frustrated system of calling frogs. *Phys. Rev. E* **83**, 031913.
- Aitta, A., Ahlers, G., and Cannell, D. S. (1985) Tricritical phenomena in rotating Taylor-Couette flow. *Phys. Rev. Lett.* **54**, 673.
- Alon, U. (2006) *An Introduction to Systems Biology: Design Principles of Biological Circuits* (Chapman & Hall/CRC Mathematical & Computational Biology, Taylor & Francis, Boca Raton, FL).
- Anderson, P. W., and Rowell, J. M. (1963) Probable observation of the Josephson superconducting tunneling effect. *Phys. Rev. Lett.* **10**, 230.
- Anderson, R. M. (1991) The Kermack-McKendrick epidemic threshold theorem. *Bull. Math. Biol.* **53**, 3.
- Andronov, A. A., Leontovich, E. A., Gordon, I. I., and Maier, A. G. (1973) *Qualitative Theory of Second-Order Dynamic Systems* (Wiley, New York).
- Arecchi, F. T., and Lisi, F. (1982) Hopping mechanism generating 1/f noise in nonlinear systems. *Phys. Rev. Lett.* **49**, 94.
- Argoul, F., Arneodo, A., Richetti, P., Roux, J. C. and Swinney, H. L. (1987) Chemical chaos: From hints to confirmation. *Acc. Chem. Res.* **20**, 436.

- Argyris, A., Syvridis, D., Larger, L., Annovazzi-Lodi, V., Colet, P., Fischer, I., Garcia-Ojalvo, J., Mirasso, C. R., Pesquera, L., and Shore, K. A. (2005) Chaos-based communications at high bit rates using commercial fibre-optic links. *Nature* **438**, 343.
- Arnold, V. I. (1978) *Mathematical Methods of Classical Mechanics* (Springer, New York).
- Aroesty, J., Lincoln, T., Shapiro, N., and Boccia, G. (1973) Tumor growth and chemotherapy: mathematical methods, computer simulations, and experimental foundations. *Math. Biosci.* **17**, 243.
- Arrowsmith, D. K., and Place, C. M. (1990) *An Introduction to Dynamical Systems* (Cambridge University Press, Cambridge, England).
- Attenborough, D. (1992) *The Trials of Life*. For synchronous fireflies, see the episode entitled "Talking to Strangers," available on videotape from Ambrose Video Publishing, 1290 Avenue of the Americas, Suite 2245, New York, NY 10104.
- Bak, P. (1986) The devil's staircase. *Phys. Today*, Dec. 1986, 38.
- Barnsley, M. F. (1988) *Fractals Everywhere* (Academic Press, Orlando, FL).
- Belousov, B. P. (1959) Oscillation reaction and its mechanism (in Russian). *Sbornik Referatov po Radiacioni Medicine*, p. 145. 1958 Meeting.
- Benardete, D. M., Noonburg, V. W., and Pollina, B. (2008) Qualitative tools for studying periodic solutions and bifurcations as applied to the periodically harvested logistic equation. *Amer. Math. Monthly* **115**, 202.
- Bender, C. M., and Orszag, S. A. (1978) *Advanced Mathematical Methods for Scientists and Engineers* (McGraw-Hill, New York).
- Benedicks, M., and Carleson, L. (1991) The dynamics of the Hénon map. *Annals of Math.* **133**, 73.
- Bergé, P., Pomeau, Y., and Vidal, C. (1984) *Order Within Chaos: Towards a Deterministic Approach to Turbulence* (Wiley, New York).
- Borrelli, R. L., and Coleman, C. S. (1987) *Differential Equations: A Modeling Approach* (Prentice-Hall, Englewood Cliffs, NJ).
- Briggs, K. (1991) A precise calculation of the Feigenbaum constants. *Mathematics of Computation* **57**, 435.
- Buck, J. (1988) Synchronous rhythmic flashing of fireflies. II. *Quart. Rev. Biol.* **63**, 265.
- Buck, J., and Buck, E. (1976) Synchronous fireflies. *Sci. Am.* **234**, May, 74.
- Campbell, D. (1979) An introduction to nonlinear dynamics. In D. L. Stein, ed. *Lectures in the Sciences of Complexity* (Addison-Wesley, Reading, MA).
- Carlson, A. J., Ivy, A. C., Krasno, L. R., and Andrews, A. H. (1942) The physiology of free fall through the air: delayed parachute jumps. *Quart. Bull. Northwestern Univ. Med. School* **16**, 254 (cited in Davis 1962).
- Cartwright, M. L. (1952) Van der Pol's equation for relaxation oscillations. *Contributions to Nonlinear Oscillations*, Vol. 2, Princeton, 3.

- Castellano, C., Fortunato, S., and Loreto, V. (2009) Statistical physics of social dynamics. *Reviews of Modern Physics* **81**, 591.
- Cesari, L. (1963) *Asymptotic Behavior and Stability Problems in Ordinary Differential Equations* (Academic, New York).
- Chance, B., Pye, E. K., Ghosh, A. K., and Hess, B., eds. (1973) *Biological and Biochemical Oscillators* (Academic Press, New York).
- Coddington, E. A., and Levinson, N. (1955) *Theory of Ordinary Differential Equations* (McGraw-Hill, New York).
- Coffman, K. G., McCormick, W. D., Simoyi, R. H., and Swinney, H. L. (1987) Universality, multiplicity, and the effect of iron impurities in the Belousov-Zhabotinskii reaction. *J. Chem. Phys.* **86**, 119.
- Collet, P., and Eckmann, J.-P. (1980) *Iterated Maps of the Interval as Dynamical Systems* (Birkhauser, Boston).
- Cox, A. (1982) Magnetostratigraphic time scale. In W. B. Harland et al., eds. *Geologic Time Scale* (Cambridge University Press, Cambridge, England).
- Crutchfield, J. P., Farmer, J. D., Packard, N. H., and Shaw, R. S. (1986) Chaos. *Sci. Am.* **254**, December, 46.
- Cuomo, K. M., and Oppenheim, A. V. (1992) Synchronized chaotic circuits and systems for communications. *MIT Research Laboratory of Electronics Technical Report No. 575*.
- Cuomo, K. M., and Oppenheim, A. V. (1993) Circuit implementation of synchronized chaos, with applications to communications. *Phys. Rev. Lett.* **71**, 65.
- Cuomo, K. M., Oppenheim, A. V., and Strogatz, S. H. (1993) Synchronization of Lorenz-based chaotic circuits with applications to communications. *IEEE Trans. Circuits and Systems II-Analog and Digital Signal Processing* **40**, 626.
- Cvitanovic, P., ed. (1989a) *Universality in Chaos*, 2nd ed. (Adam Hilger, Bristol and New York).
- Cvitanovic, P. (1989b) Universality in chaos. In P. Cvitanovic, ed. *Universality in Chaos*, 2nd ed. (Adam Hilger, Bristol and New York).
- Davis, H. T. (1962) *Introduction to Nonlinear Differential and Integral Equations* (Dover, New York).
- Devaney, R. L. (1989) *An Introduction to Chaotic Dynamical Systems*, 2nd ed. (Addison-Wesley, Redwood City, CA).
- Dowell, E. H., and Ilgamova, M. (1988) *Studies in Nonlinear Aeroelasticity* (Springer, New York).
- Drazin, P. G. (1992) *Nonlinear Systems* (Cambridge University Press, Cambridge, England).
- Drazin, P. G., and Reid, W. H. (1981) *Hydrodynamic Stability* (Cambridge University Press, Cambridge, England).

- Dubois, M., and Bergé, P. (1978) Experimental study of the velocity field in Rayleigh-Bénard convection. *J. Fluid Mech.* **85**, 641.
- Eckmann, J.-P., and Ruelle, D. (1985) Ergodic theory of chaos and strange attractors. *Rev. Mod. Phys.* **57**, 617.
- Edelstein-Keshet, L. (1988) *Mathematical Models in Biology* (Random House, New York).
- Eigen, M. and Schuster, P. (1978) The hypercycle: A principle of natural self-organization. Part B: The abstract hypercycle. *Naturwissenschaften* **65**, 7.
- Epstein, I. R., Kustin, K., De Kepper, P., and Orban, M. (1983) Oscillating chemical reactions. *Sci. Am.* **248**(3), 112.
- Ermentrout, G. B. (1991) An adaptive model for synchrony in the firefly *Pterop-tyx malaccae*. *J. Math. Biol.* **29**, 571.
- Ermentrout, G. B., and Kopell, N. (1990) Oscillator death in systems of coupled neural oscillators. *SIAM J. Appl. Math.* **50**, 125.
- Ermentrout, G. B., and Rinzel, J. (1984) Beyond a pacemaker's entrainment limit: phase walk-through. *Am. J. Physiol.* **246**, R102.
- Euler, L. (1777) De formulis exponentialibus replicatus. *Opera Omnia, Series Primus XV*, 268; *Acta Academiae Scientiarum Petropolitanae* **1**, 38.
- Fairén, V., and Velarde, M. G. (1979) Time-periodic oscillations in a model for the respiratory process of a bacterial culture. *J. Math. Biol.* **9**, 147.
- Falconer, K. (1990) *Fractal Geometry: Mathematical Foundations and Applications* (Wiley, Chichester, England).
- Farmer, J. D. (1985) Sensitive dependence on parameters in nonlinear dynamics. *Phys. Rev. Lett.* **55**, 351.
- Feder, J. (1988) *Fractals* (Plenum, New York).
- Feigenbaum, M. J. (1978) Quantitative universality for a class of nonlinear transformations. *J. Stat. Phys.* **19**, 25.
- Feigenbaum, M. J. (1979) The universal metric properties of nonlinear transformations. *J. Stat. Phys.* **21**, 69.
- Feigenbaum, M. J. (1980) Universal behavior in nonlinear systems. *Los Alamos Sci.* **1**, 4.
- Feynman, R. P., Leighton, R. B., and Sands, M. (1965) *The Feynman Lectures on Physics* (Addison-Wesley, Reading, MA).
- Field, R., and Burger, M., eds. (1985) *Oscillations and Traveling Waves in Chemical Systems* (Wiley, New York).
- Firth, W. J. (1986) Instabilities and chaos in lasers and optical resonators. In A. V. Holden, ed. *Chaos* (Princeton University Press, Princeton, NJ).
- Fraser, A. M. and Swinney, H. L. (1986) Independent coordinates for strange attractors from mutual information. *Phys. Rev. A* **33**, 1134.
- Gaspard, P. (1990) Measurement of the instability rate of a far-from-equilibrium steady state at an infinite period bifurcation. *J. Phys. Chem.* **94**, 1.

- Geddes, J. B., Short, K. M., and Black, K. (1999) Extraction of signals from chaotic laser data. *Phys. Rev. Lett.* **83**, 5389.
- Giglio, M., Musazzi, S., and Perini, V. (1981) Transition to chaotic behavior via a reproducible sequence of period-doubling bifurcations. *Phys. Rev. Lett.* **47**, 243.
- Glass, L. (1977) Patterns of supernumerary limb regeneration. *Science* **198**, 321.
- Glazier, J. A., and Libchaber, A. (1988) Quasiperiodicity and dynamical systems: an experimentalist's view. *IEEE Trans. on Circuits and Systems* **35**, 790.
- Gleick, J. (1987) *Chaos: Making a New Science* (Viking, New York).
- Goldbeter, A. (1980) Models for oscillations and excitability in biochemical systems. In L. A. Segel, ed., *Mathematical Models in Molecular and Cellular Biology* (Cambridge University Press, Cambridge, England).
- Grassberger, P. (1981) On the Hausdorff dimension of fractal attractors. *J. Stat. Phys.* **26**, 173.
- Grassberger, P., and Procaccia, I. (1983) Measuring the strangeness of strange attractors. *Physica D* **9**, 189.
- Gray, P., and Scott, S. K. (1985) Sustained oscillations and other exotic patterns of behavior in isothermal reactions. *J. Phys. Chem.* **89**, 22.
- Grebogi, C., Ott, E., and Yorke, J. A. (1983a) Crises, sudden changes in chaotic attractors and transient chaos. *Physica D* **7**, 181.
- Grebogi, C., Ott, E., and Yorke, J. A. (1983b) Fractal basin boundaries, long-lived chaotic transients, and unstable-unstable pair bifurcation. *Phys. Rev. Lett.* **50**, 935.
- Grebogi, C., Ott, E., and Yorke, J. A. (1987) Chaos, strange attractors, and fractal basin boundaries in nonlinear dynamics. *Science* **238**, 632.
- Griffith, J. S. (1971) *Mathematical Neurobiology* (Academic Press, New York).
- Grimshaw, R. (1990) *Nonlinear Ordinary Differential Equations* (Blackwell, Oxford, England).
- Guckenheimer, J., and Holmes, P. (1983) *Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields* (Springer, New York).
- Haken, H. (1983) *Synergetics*, 3rd ed. (Springer, Berlin).
- Halsey, T., Jensen, M. H., Kadanoff, L. P., Procaccia, I. and Shraiman, B. I. (1986) Fractal measures and their singularities: the characterization of strange sets. *Phys. Rev. A* **33**, 1141.
- Hanson, F. E. (1978) Comparative studies of firefly pacemakers. *Federation Proc.* **37**, 2158.
- Hao, Bai-Lin, ed. (1990) *Chaos II* (World Scientific, Singapore).
- Hao, Bai-Lin, and Zheng, W.-M. (1989) Symbolic dynamics of unimodal maps revisited. *Int. J. Mod. Phys. B* **3**, 235.
- Hardie, D. G., ed. (1999) *Protein Phosphorylation: A Practical Approach* (Oxford University Press, Oxford/New York).
- Harrison, R. G., and Biswas, D. J. (1986) Chaos in light. *Nature* **321**, 504.

- He, R., and Vaidya, P. G. (1992) Analysis and synthesis of synchronous periodic and chaotic systems. *Phys. Rev. A* **46**, 7387.
- Helleman, R. H. G. (1980) Self-generated chaotic behavior in nonlinear mechanics. In E. G. D. Cohen, ed. *Fundamental Problems in Statistical Mechanics* **5**, 165.
- Hénon, M. (1969) Numerical study of quadratic area-preserving mappings. *Quart. Appl. Math.* **27**, 291.
- Hénon, M. (1976) A two-dimensional mapping with a strange attractor. *Commun. Math. Phys.* **50**, 69.
- Hénon, M. (1983) Numerical exploration of Hamiltonian systems. In G. Iooss, R. H. G. Helleman, and R. Stora, eds. *Chaotic Behavior of Deterministic Systems* (North-Holland, Amsterdam).
- Hirsch, J. E., Nauenberg, M., and Scalapino, D. J. (1982) Intermittency in the presence of noise: a renormalization group formulation. *Phys. Lett. A* **87**, 391.
- Hobson, D. (1993) An efficient method for computing invariant manifolds of planar maps. *J. Comp. Phys.* **104**, 14.
- Hofbauer, J., and Sigmund, K. (1998) *Evolutionary Games and Population Dynamics* (Cambridge University Press, Cambridge, UK).
- Holmes, P. (1979) A nonlinear oscillator with a strange attractor. *Phil. Trans. Roy. Soc. A* **292**, 419.
- Hubbard, J. H., and West, B. H. (1991) *Differential Equations: A Dynamical Systems Approach, Part I* (Springer, New York).
- Hurewicz, W. (1958) *Lectures on Ordinary Differential Equations* (MIT Press, Cambridge, MA).
- Jackson, E. A. (1990) *Perspectives of Nonlinear Dynamics*, Vols. 1 and 2 (Cambridge University Press, Cambridge, England).
- Jensen, R. V. (1987) Classical chaos. *Am. Scientist* **75**, 168.
- Jordan, D. W., and Smith, P. (1987) *Nonlinear Ordinary Differential Equations*, 2nd ed. (Oxford University Press, Oxford, England).
- Josephson, B. D. (1962) Possible new effects in superconductive tunneling. *Phys. Lett.* **1**, 251.
- Josephson, B. D. (1982) Interview. *Omni*, July 1982, p. 87.
- Kaplan, D. T., and Glass, L. (1993) Coarse-grained embeddings of time series: random walks, Gaussian random processes, and deterministic chaos. *Physica D* **64**, 431.
- Kaplan, J. L., and Yorke, J. A. (1979) Preturbulence: A regime observed in a fluid flow model of Lorenz. *Commun. Math. Phys.* **67**, 93.
- Kermack, W. O., and McKendrick, A. G. (1927) Contributions to the mathematical theory of epidemics—I. *Proc. Roy. Soc. A* **115A**, 700.
- Kirkup, B. C., and Riley, M. A. (2004) Antibiotic-mediated antagonism leads to a bacterial game of rock–paper–scissors in vivo. *Nature* **428**, 412.

- Knoebel, R. A. (1981) Exponentials reiterated. *Amer. Math. Monthly* **88**, 235.
- Kocak, H. (1989) *Differential and Difference Equations Through Computer Experiments*, 2nd ed. (Springer, New York).
- Kolar, M., and Gums, G. (1992) Theory for the experimental observation of chaos in a rotating waterwheel. *Phys. Rev. A* **45**, 626.
- Kolata, G. B. (1977) Catastrophe theory: the emperor has no clothes. *Science* **196**, 287.
- Krebs, C. J. (1972) *Ecology: The Experimental Analysis of Distribution and Abundance* (Harper and Row, New York).
- Lengyel, I., and Epstein, I. R. (1991) Modeling of Turing structures in the chlorite-iodide-malonic acid-starch reaction. *Science* **251**, 650.
- Lengyel, I., Rabai, G., and Epstein, I. R. (1990) Experimental and modeling study of oscillations in the chlorine dioxide-iodine-malonic acid reaction. *J. Am. Chem. Soc.* **112**, 9104.
- Levi, M., Hoppensteadt, F., and Miranker, W. (1978) Dynamics of the Josephson junction. *Quart. Appl. Math.* **35**, 167.
- Lewis, J., Slack, J. M. W., and Wolpert, L. (1977) Thresholds in development. *J. Theor. Biol.* **65**, 579.
- Libchaber, A., Laroche, C., and Fauve, S. (1982) Period doubling cascade in mercury, a quantitative measurement. *J. Physique Lett.* **43**, L211.
- Lichtenberg, A. J., and Lieberman, M. A. (1992) *Regular and Chaotic Dynamics*, 2nd ed. (Springer, New York).
- Lighthill, J. (1986) The recently recognized failure of predictability in Newtonian dynamics. *Proc. Roy. Soc. Lond. A* **407**, 35.
- Lin, C. C., and Segel, L. (1988) *Mathematics Applied to Deterministic Problems in the Natural Sciences* (SIAM, Philadelphia).
- Lindsay, P. (1981) Period doubling and chaotic behavior in a driven anharmonic oscillator. *Phys. Rev. Lett.* **47**, 1349.
- Lorenz, E. N. (1963) Deterministic nonperiodic flow. *J. Atmos. Sci.* **20**, 130.
- Lozi, R. (1978) Un attracteur étrange du type attracteur de Hénon. *J. Phys. (Paris)* **39** (C5), 9.
- Ludwig, D., Jones, D. D., and Holling, C. S. (1978) Qualitative analysis of insect outbreak systems: the spruce budworm and forest. *J. Anim. Ecol.* **47**, 315.
- Ludwig, D., Aronson, D. G., and Weinberger, H. F. (1979) Spatial patterning of the spruce budworm. *J. Math. Biol.* **8**, 217.
- Ma, S.-K. (1976) *Modern Theory of Critical Phenomena* (Benjamin/Cummings, Reading, MA).
- Ma, S.-K. (1985) *Statistical Mechanics* (World Scientific, Singapore).
- Malkus, W. V. R. (1972) Non-periodic convection at high and low Prandtl number. *Mémoires Société Royale des Sciences de Liège*, Series 6, Vol. 4, 125.

- Mandelbrot, B. B. (1982) *The Fractal Geometry of Nature* (Freeman, San Francisco).
- Manneville, P. (1990) *Dissipative Structures and Weak Turbulence* (Academic, Boston).
- Marsden, J. E., and McCracken, M. (1976) *The Hopf Bifurcation and Its Applications* (Springer, New York).
- Marvel, S. A., Hong, H., Papush, A., and Strogatz, S. H. (2012) Encouraging moderation: Clues from a simple model of ideological conflict. *Phys. Rev. Lett.* **109**, 118702.
- May, R. M. (1972) Limit cycles in predator-prey communities. *Science* **177**, 900.
- May, R. M. (1976) Simple mathematical models with very complicated dynamics. *Nature* **261**, 459.
- May, R. M. (1981) *Theoretical Ecology: Principles and Applications*, 2nd ed. (Blackwell, Oxford, England).
- May, R. M., and Anderson, R. M. (1987) Transmission dynamics of HIV infection. *Nature* **326**, 137.
- May, R. M., and Oster, G. F. (1980) Period-doubling and the onset of turbulence: an analytic estimate of the Feigenbaum ratio. *Phys. Lett. A* **78**, 1.
- McCumber, D. E. (1968) Effect of ac impedance on dc voltage-current characteristics of superconductor weak-link junctions. *J. Appl. Phys.* **39**, 3113.
- Metropolis, N., Stein, M. L., and Stein, P. R. (1973) On finite limit sets for transformations on the unit interval. *J. Combin. Theor.* **15**, 25.
- Milnor, J. (1985) On the concept of attractor. *Commun. Math. Phys.* **99**, 177.
- Milonni, P. W., and Eberly, J. H. (1988) *Lasers* (Wiley, New York).
- Minorsky, N. (1962) *Nonlinear Oscillations* (Van Nostrand, Princeton, NJ).
- Mirollo, R. E., and Strogatz, S. H. (1990) Synchronization of pulse-coupled biological oscillators. *SIAM J. Appl. Math.* **50**, 1645.
- Misiurewicz, M. (1980) Strange attractors for the Lozi mappings. *Ann. N. Y. Acad. Sci.* **357**, 348.
- Moon, F. C. (1992) *Chaotic and Fractal Dynamics: An Introduction for Applied Scientists and Engineers* (Wiley, New York).
- Moon, F. C., and Holmes, P. J. (1979) A magnetoelastic strange attractor. *J. Sound. Vib.* **65**, 275.
- Moon, F. C., and Li, G.-X. (1985) Fractal basin boundaries and homoclinic orbits for periodic motion in a two-well potential. *Phys. Rev. Lett.* **55**, 1439.
- Moore-Ede, M. C., Sulzman, F. M., and Fuller, C. A. (1982) *The Clocks That Time Us* (Harvard University Press, Cambridge, MA).
- Munkres, J. R. (1975) *Topology: A First Course* (Prentice-Hall, Englewood Cliffs, NJ).
- Murray, J. D. (2002) *Mathematical Biology. I: An Introduction*, 3rd edition (Springer, New York).

- Murray, J. D. (2003) *Mathematical Biology. II: Spatial Models and Biomedical Applications, 3rd edition* (Springer, New York).
- Myrberg, P. J. (1958) Iteration von Quadratwurzeloperationen. *Annals Acad. Sci. Fennicae A I Math.* **259**, 1.
- Nahin, P. J. (2007) *Chases and Escapes: The Mathematics of Pursuit and Evasion* (Princeton University Press, Princeton, NJ).
- Nayfeh, A. (1973) *Perturbation Methods* (Wiley, New York).
- Newton, C. M. (1980) Biomathematics in oncology: modelling of cellular systems. *Ann. Rev. Biophys. Bioeng.* **9**, 541.
- Nowak, M. A. (2006) *Evolutionary Dynamics: Exploring the Equations of Life* (Belknap/Harvard, Cambridge, MA).
- Odell, G. M. (1980) Qualitative theory of systems of ordinary differential equations, including phase plane analysis and the use of the Hopf bifurcation theorem. Appendix A.3. In L. A. Segel, ed., *Mathematical Models in Molecular and Cellular Biology* (Cambridge University Press, Cambridge, England).
- Olsen, L. F., and Degn, H. (1985) Chaos in biological systems. *Quart. Rev. Biophys.* **18**, 165.
- Packard, N. H., Crutchfield, J. P., Farmer, J. D., and Shaw, R. S. (1980) Geometry from a time series. *Phys. Rev. Lett.* **45**, 712.
- Palmer, R. (1989) Broken ergodicity. In D. L. Stein, ed. *Lectures in the Sciences of Complexity* (Addison-Wesley, Reading, MA).
- Pearl, R. (1927) The growth of populations. *Quart. Rev. Biol.* **2**, 532.
- Pecora, L. M., and Carroll, T. L. (1990) Synchronization in chaotic systems. *Phys. Rev. Lett.* **64**, 821.
- Pedersen, N. F. and Saermark, K. (1973) Analytical solution for a Josephson-junction model with capacitance. *Physica* **69**, 572.
- Peitgen, H.-O., and Richter, P. H. (1986) *The Beauty of Fractals* (Springer, New York).
- Perko, L. (1991) *Differential Equations and Dynamical Systems* (Springer, New York).
- Pianka, E. R. (1981) Competition and niche theory. In R. M. May, ed. *Theoretical Ecology: Principles and Applications* (Blackwell, Oxford, England).
- Pielou, E. C. (1969) *An Introduction to Mathematical Ecology* (Wiley-Interscience, New York).
- Politi, A., Oppo, G. L., and Badii, R. (1986) Coexistence of conservative and dissipative behavior in reversible dynamical systems. *Phys. Rev. A* **33**, 4055.
- Pomeau, Y., and Manneville, P. (1980) Intermittent transition to turbulence in dissipative dynamical systems. *Commun. Math. Phys.* **74**, 189.
- Poston, T., and Stewart, I. (1978) *Catastrophe Theory and Its Applications* (Pitman, London).

- Press, W. H., Teukolsky, S. A., Vetterling, W. T., and Flannery, B. P. (2007) *Numerical Recipes: The Art of Scientific Computing, 3rd edition* (Cambridge University Press, Cambridge, England).
- Rikitake, T. (1958) Oscillations of a system of disk dynamos. *Proc. Camb. Phil. Soc.* **54**, 89.
- Rinaldi, S., Della Rossa, F., and Landi, P. (2013) A mathematical model of “Gone with the Wind.” *Physica A* **392**, 3231.
- Rinzel, J., and Ermentrout, G. B. (1989) Analysis of neural excitability and oscillations. In C. Koch and I. Segev, eds. *Methods in Neuronal Modeling: From Synapses to Networks* (MIT Press, Cambridge, MA).
- Rippon, P. J. (1983) Infinite exponentials. *Math. Gazette* **67** (441), 189.
- Robbins, K. A. (1977) A new approach to subcritical instability and turbulent transitions in a simple dynamo. *Math. Proc. Camb. Phil. Soc.* **82**, 309.
- Robbins, K. A. (1979) Periodic solutions and bifurcation structure at high  $r$  in the Lorenz system. *SIAM J. Appl. Math.* **36**, 457.
- Rössler, O. E. (1976) An equation for continuous chaos. *Phys. Lett. A* **57**, 397.
- Roux, J. C., Simoyi, R. H., and Swinney, H. L. (1983) Observation of a strange attractor. *Physica D* **8**, 257.
- Ruelle, D., and Takens, F. (1971) On the nature of turbulence. *Commun. Math. Phys.* **20**, 167.
- Saha, P., and Strogatz, S. H. (1995) The birth of period three. *Math. Mag.* **68**(1), 42.
- Schmitz, R. A., Graziani, K. R., and Hudson, J. L. (1977) Experimental evidence of chaotic states in the Belousov-Zhabotinskii reaction. *J. Chem. Phys.* **67**, 3040.
- Schnackenberg, J. (1979) Simple chemical reaction systems with limit cycle behavior. *J. Theor. Biol.* **81**, 389.
- Schroeder, M. (1991) *Fractals, Chaos, Power Laws* (Freeman, New York).
- Schuster, H. G. (1989) *Deterministic Chaos*, 2nd ed. (VCH, Weinheim, Germany).
- Sel'kov, E. E. (1968) Self-oscillations in glycolysis. A simple kinetic model. *Eur. J. Biochem.* **4**, 79.
- Short, K. M. (1994) Steps toward unmasking secure communications. *Int. J. Bifurcation Chaos* **4**, 959.
- Short, K. M. (1996) Unmasking a modulated chaos communications scheme. *Int. J. Bifurcation Chaos* **6**, 367.
- Shapiro, A., Curtu, R., Rinzel, J., and Rubin, N. (2007) Dynamical characteristics common to neuronal competition models. *J. Neurophysiol.* **97**, 462.
- Sigmund, K. (2010) *The Calculus of Selfishness* (Princeton University Press, Princeton, NJ).
- Simó, C. (1979) On the Hénon-Pomeau attractor. *J. Stat. Phys.* **21**, 465.
- Simoyi, R. H., Wolf, A., and Swinney, H. L. (1982) One-dimensional dynamics in a multicomponent chemical reaction. *Phys. Rev. Lett.* **49**, 245.

- Sinervo, B., and Lively, C. M. (1996) The rock–paper–scissors game and the evolution of alternative male strategies. *Nature* **380**, 240.
- Smale, S. (1967) Differentiable dynamical systems. *Bull. Am. Math. Soc.* **73**, 747.
- Sparrow, C. (1982) *The Lorenz Equations: Bifurcations, Chaos, and Strange Attractors* (Springer, New York) *Appl. Math. Sci.* **41**.
- Stewart, I. (2000) The Lorenz attractor exists. *Nature* **406**, 948.
- Stewart, W. C. (1968) Current-voltage characteristics of Josephson junctions. *Appl. Phys. Lett.* **12**, 277.
- Stoker, J. J. (1950) *Nonlinear Vibrations* (Wiley, New York).
- Stone, H. A., Nadim, A., and Strogatz, S. H. (1991) Chaotic streamlines inside drops immersed in steady Stokes flows. *J. Fluid Mech.* **232**, 629.
- Strogatz, S. H. (1985) Yeast oscillations, Belousov-Zhabotinsky waves, and the nonretraction theorem. *Math. Intelligencer* **7** (2), 9.
- Strogatz, S. H. (1986) *The Mathematical Structure of the Human Sleep-Wake Cycle*. Lecture Notes in Biomathematics, Vol. **69**. (Springer, New York).
- Strogatz, S. H. (1987) Human sleep and circadian rhythms: a simple model based on two coupled oscillators. *J. Math. Biol.* **25**, 327.
- Strogatz, S. H. (1988) Love affairs and differential equations. *Math. Magazine* **61**, 35.
- Strogatz, S. H., Marcus, C. M., Westervelt, R. M., and Mirollo, R. E. (1988) Simple model of collective transport with phase slippage. *Phys. Rev. Lett.* **61**, 2380.
- Strogatz, S. H., Marcus, C. M., Westervelt, R. M., and Mirollo, R. E. (1989) Collective dynamics of coupled oscillators with random pinning. *Physica D* **36**, 23.
- Strogatz, S. H., and Mirollo, R. E. (1993) Splay states in globally coupled Josephson arrays: analytical prediction of Floquet multipliers. *Phys. Rev. E* **47**, 220.
- Strogatz, S. H., and Westervelt, R. M. (1989) Predicted power laws for delayed switching of charge-density waves. *Phys. Rev. B* **40**, 10501.
- Sullivan, D. B., and Zimmerman, J. E. (1971) Mechanical analogs of time dependent Josephson phenomena. *Am. J. Phys.* **39**, 1504.
- Tabor, M. (1989) *Chaos and Integrability in Nonlinear Dynamics: An Introduction* (Wiley-Interscience, New York).
- Takens, F. (1981) Detecting strange attractors in turbulence. *Lect. Notes in Math.* **898**, 366.
- Testa, J. S., Perez, J., and Jeffries, C. (1982) Evidence for universal chaotic behavior of a driven nonlinear oscillator. *Phys. Rev. Lett.* **48**, 714.
- Thompson, J. M. T., and Stewart, H. B. (1986) *Nonlinear Dynamics and Chaos* (Wiley, Chichester, England).
- Tsang, K. Y., Mirollo, R. E., Strogatz, S. H., and Wiesenfeld, K. (1991) Dynamics of a globally coupled oscillator array. *Physica D* **48**, 102.

- Tucker, W. (1999) The Lorenz attractor exists. *C. R. Acad. Sci.* **328**, 1197.
- Tucker, W. (2002) A rigorous ODE solver and Smale's 14th problem. *Found. Comput. Math.* **2**, 53.
- Tyson, J. J. (1985) A quantitative account of oscillations, bistability, and travelling waves in the Belousov–Zhabotinskii reaction. In R. J. Field and M. Burger, eds. *Oscillations and Traveling Waves in Chemical Systems* (Wiley, New York).
- Tyson, J. J. (1991) Modeling the cell division cycle: cdc2 and cyclin interactions. *Proc. Natl. Acad. Sci. USA* **88**, 7328.
- Van Duzer, T., and Turner, C. W. (1981) *Principles of Superconductive Devices and Circuits* (Elsevier, New York).
- Van Wijgeren, G. D. and Roy, R. (1998) Communications with chaotic lasers. *Science* **279**, 1198.
- Vasquez, F., and Redner, S. (2004) Ultimate fate of constrained voters. *J. Phys. A: Math. Gen.* **37**, 8479.
- Viana, M. (2000) What's new on Lorenz strange attractors? *Math. Intelligencer* **22** (3), 6.
- Vohra, S., Spano, M., Shlesinger, M., Pecora, L., and Ditto, W. (1992) *Proceedings of the First Experimental Chaos Conference* (World Scientific, Singapore).
- Wade, N. J. (1996) Descriptions of visual phenomena from Aristotle to Wheatstone. *Perception* **25**, 1137.
- Weiss, C. O., and Vilaseca, R. (1991) *Dynamics of Lasers* (VCH, Weinheim, Germany).
- Wiggins, S. (1990) *Introduction to Applied Nonlinear Dynamical Systems and Chaos* (Springer, New York).
- Winfree, A. T. (1972) Spiral waves of chemical activity. *Science* **175**, 634.
- Winfree, A. T. (1974) Rotating chemical reactions. *Sci. Amer.* **230** (6), 82.
- Winfree, A. T. (1980) *The Geometry of Biological Time* (Springer, New York).
- Winfree, A. T. (1984) The prehistory of the Belousov–Zhabotinsky reaction. *J. Chem. Educ.* **61**, 661.
- Winfree, A. T. (1987a) *The Timing of Biological Clocks* (Scientific American Library).
- Winfree, A. T. (1987b) *When Time Breaks Down* (Princeton University Press, Princeton, NJ).
- Winfree, A. T., and Strogatz, S. H. (1984) Organizing centers for three-dimensional chemical waves. *Nature* **311**, 611.
- Xie, J., Sreenivasan, S., Korniss, G., Zhang, W., Lim, C., and Szymanski, B. K. (2011) Social consensus through the influence of committed minorities. *Phys. Rev. E* **84**, 011130.
- Xiong, W., and Ferrell, J. E., Jr. (2003) A positive-feedback-based bistable 'memory module' that governs a cell fate decision. *Nature* **426**, 460.

- Yeh, W. J., and Kao, Y. H. (1982) Universal scaling and chaotic behavior of a Josephson junction analog. *Phys. Rev. Lett.* **49**, 1888.
- Yorke, E. D., and Yorke, J. A. (1979) Metastable chaos: Transition to sustained chaotic behavior in the Lorenz model. *J. Stat. Phys.* **21**, 263.
- Zahler, R. S., and Sussman, H. J. (1977) Claims and accomplishments of applied catastrophe theory. *Nature* **269**, 759.
- Zaikin, A. N., and Zhabotinsky, A. M. (1970) Concentration wave propagation in two-dimensional liquid-phase self-organizing system. *Nature* **225**, 535.
- Zeeman, E. C. (1977) *Catastrophe Theory: Selected Papers 1972–1977* (Addison-Wesley, Reading, MA).