#### BIBLIOGRAPHY

As a reading of Chapter 7 should make clear, many recent advances in dynamical systems research stem from ideas of Stephen Smale, and his 1967 survey article (Smale [5]) has been profoundly influential. Some other surveys that may help to guide further reading on the subject are Nemitskii [1], Palis [2], Robbin [3], Shub [2, 3, 4, 5] and Smale [7, 8]. In the list of references that follows, two conference proceedings appear so often that I have abbreviated them. "Global Analysis" denotes "Global Analysis, Proc. Symp. in Pure Math. 14 (Providence, Rhode Island: American Math. Soc., 1970)", and "Dynamical Systems" denotes "Dynamical Systems (Ed. Peixoto, M. M.) (New York: Academic Press, 1973).

ABRAHAM, R. (assisted by MARSDEN, J. E.)

1. "Foundations of Mechanics", Benjamin, New York, 1967.

ABRAHAM, R. and ROBBIN, J.

- 1. "Transversal Mappings and Flows". Benjamin, New York, 1967. ABRAHAM, R. and SMALE, S.
  - 1. Non-genericity of  $\Omega$ -stability. Global Analysis, 5-8.

ANDRONOV, A. and PONTRJAGIN, L.

- 1. Systèmes grossiers. *Dokl. Akad. Nauk SSSR* 14 (1937), 247–251. ANOSOV, D.
  - Roughness of geodesic flows on compact Riemannian manifolds of negative curvature. Dokl. Akad. Nauk SSSR 145 (1962), 707-709 (English: Soviet Math. Dokl. 3 (1962), 1068-1070.)
  - 2. Geodesic flows on compact Riemannian manifolds of negative curvature. Trudy Mat. Inst. Steklov 90 (1967) (English: Amer. Math. Soc. translation (1969).)

#### ANTOSIEWICZ, H. A.

1. A survey of Lyapunov's second method. "Contributions to the Theory of Non-Linear Oscillations". (Ed. Lefschetz, S.), Vol. 4, pp. 141–166. Annals of Math. Study 41, Princeton University Press, Princeton, 1958.

#### ARNOLD, V. I.

1. "Ordinary Differential Equations". MIT Press, Cambridge, Massachusetts, 1973.

#### BIRKHOFF, G. D.

1. "Dynamical Systems". Amer. Math. Soc. Colloquium Pub. 9 American Math. Soc., New York, 1927.

#### BOURBAKI, N.

 "General Topology, Part II". Herman and Addison-Wesley, Reading, Mass., 1966.

## BRICKELL, F. and CLARK, R. S.

1. "Differentiable Manifolds". Van Nostrand Reinhold, London, 1970.

#### CHILLINGWORTH, D. R. J.

1. "Differential Topology with a View to Applications". Pitman, London, 1976.

# CODDINGTON, E. A. and LEVINSON, N.

 "Theory of Ordinary Differential Equations". McGraw-Hill, New York, 1955.

#### DANKNER, A.

1. On Smale's Axiom A dynamical systems. Astérisque 49 (1977), 19-22.

#### DE BAGGIS, H. F.

1. Dynamical systems with stable structures. "Contributions to the Theory of Non-Linear Oscillations". (Ed. Lefschetz, S), Vol. 2, pp. 37-59. Annals of Math. Study 29, Princeton University Press, Princeton, 1952.

#### DENJOY, A.

1. Sur les courbes définies par les équations différentielles à la surface du tore. J. de Math. Pure et Appl. 11 (1932), 333-375.

#### DE OLIVIERA, M.

1. C<sup>0</sup>-density of structurally stable vector fields. Bull. Amer. Math. Soc. 82 (1976).

#### DIEUDONNE, J.

1. "Foundations of Modern Analysis". Academic Press, New York and London, 1960.

#### DUNFORD, N. and SCHWARTZ, J. T.

1. "Linear Operators" Part 1. Interscience, New York, 1958.

## ELIASSON, H. I.

- 1. Geometry of manifolds of maps. *J. Differential Geometry* **1** (1967), 169–194. FOSTER, M. J.
  - 1. Calculus on vector bundles. J. London Math. Soc. (2) 11 (1975), 65-73.
  - 2. Fibre derivatives and stable manifolds: a note. *Bull. London Math. Soc.* 8 (1976), 286-288.

## FRANKS, J.

- 1. "Manifolds of C'-mappings".
- 2. Differentiably  $\Omega$ -stable diffeomorphisms. Topology 11 (1972), 107–114.
- 3. Absolutely structurally stable diffeomorphisms. *Proc. Amer. Math. Soc.* 37 (1973), 293–296.
- 4. Constructing structurally stable diffeomorphisms. Annals of Math. 105 (1977), 343-359.

# GANTMACHER, F. R.

1. "The Theory of Matrices" Vol. 1. Chelsea, New York, 1959.

#### GREENBERG, M. J.

1. "Lectures on Algebraic Topology". Benjamin, New York, 1967.

#### GROBMAN, D. M.

- 1. Homeomorphisms of systems of differential equations. Dokl. Akad. Nauk SSSR 128 (1959), 880-881.
- 2. Topological classification of the neighbourhood of a singular point in *n*-dimensional space. *Mat. Sb.* (*N.S*) **56** (98) (1962), 77–94.

#### GUCKENHEIMER, J.

- 1. Absolutely  $\Omega$ -stable diffeomorphisms. Topology 11 (1972), 195–197.
- 2. Bifurcation and catastrophe. Dynamical Systems, 95-110.
- 3. One parameter families of vector fields on two-manifolds: another non-density theorem. *Dynamical Systems*, 111-127.

GUILLEMIN, V. and POLLACK, A.

- 1. "Differential topology". Prentice-Hall, Englewood Cliffs, New Jersey, 1974. GUTIERREZ, C.
  - 1. Structural stability for flows on the torus with a cross-cap. Trans. Amer. Math. Soc. 241 (1978), 311-320.

HALE, J. K.

- 1. "Ordinary Differential Equations". Wiley-Interscience, New York, 1969. HARTMAN, P.
  - 1. "Ordinary Differential Equations", Wiley, New York, 1964.

HELGASON, S.

1. "Differential Geometry and Symmetric Spaces". Academic Press, New York and London, 1953.

HIRSCH, M. W.

1. "Differential Topology". Springer-Verlag, New York, 1976.

HIRSCH, M. W. and PUGH, C. C.

1. Stable manifolds and hyperbolic sets. Global Analysis, 133-163.

HIRSCH, M. W. and SMALE, S.

1. "Differential Equations, Dynamical Systems, and Linear Algebra". Academic Press, New York and London, 1974.

HIRSCH, M. W., PUGH, C. C. and SHUB, M.

1. "Invariant Manifolds". Springer Lecture Notes No. 583 (1977).

HOLMES, R. B.

1. A formula for the spectral radius of an operator. Amer. Math. Monthly 75 (1968), 163–166. HOPF, E.

1. Anzweigung einer periodischen lösung von einer stationären lösung eines differentialsystems. Ber. Verh. Sächs, Akad. Wiss. Leipzig Math. Phys. 95 (1943), 3-22.

HU, S.-T.

- 1. "Introduction to general topology". Holden-Day, San Francisco, 1966.
- 2. "Homology theory". Holden-Day, San Francisco, 1966.

HUREWICZ, W.

1. "Lectures on Ordinary Differential Equations". MIT Press, Cambridge, Mass., 1958.

IRWIN, M. C.

- 1. Transformation groups with a common orbit. Bull. London Math. Soc. 5 (1973), 164-168.
- 2. A new proof of the pseudo-stable manifold theorem. J. London Math. Soc. (to appear).

KERVAIRE, M.

1. A manifold which does not admit any differentiable structure. Comm. Math. Helv. 34 (1960), 304-312.

KUIPER, N. H.

- 1. The homotopy type of the unitary group of Hilbert space. Topology 3 (1965), 19-30.
- 2. The topology of the solutions of a linear differential equation on R<sup>n</sup>. Manifolds-Tokyo 1973, pp. 195-203. Univ. Tokyo Press, Tokyo, 1975.

KUIPER, N. H. and ROBBIN, J. W.

1. Topological classification of linear endomorphisms. Invent. Math. 19 (1973), 83-106.

## KUPKA, I.

- 1. Contribution à la théorie des champs génériques. "Contributions to Differential Equations" Vol. 2 (1963), pp. 457-484: Vol. 3 (1964), pp. 411-420. Wiley-Interscience, New York.
- 2. On two notions of structural stability. J. Differential Geometry 9 (1974), 639-644.

# LANG, S.

- 1. "Differential manifolds". Addison-Wesley, Reading, Mass., 1972.
- 2. "Analysis II". Addison-Wesley, Reading, Mass., 1969.

#### LESLIE, J.

1. On a differential structure for the group of diffeomorphisms. *Topology* 6 (1967), 263-271.

# LEFSCHETZ, S.

1. "Differential Equations, Geometric Theory". Wiley-Interscience, New York, 1957.

#### LIAPUNOV, A. M.

1. "Problème général de la stabilité du mouvement." Annals of Math. Study 17. Princeton University Press, Princeton, 1947.

#### MANNING, A.

1. There are no new Anosov diffeomorphisms on tori. *Amer. Jour. Math.* **96** (1974), 422-429.

# MAUNDER, C. R. F.

1. "Algebraic Topology". Van Nostrand Reinhold, London, 1970.

#### MARKLEY, N.

1. Homeomorphisms of the circle without periodic points. *Proc. London Math. Soc.* (3) **20** (1970), 688-698.

# MATHER, J.

1. Characterization of Anosov diffeomorphisms. Nederl. Akad. van Wetensch. Proc. Ser. A, Amsterdam 71 = Indag. Math. 30 (1968), 479-483.

#### MAZUR, B.

1. Pub. Math. I.H.E.S. 15 (1963) (also 22 (1964), 81–92).

#### MILNOR, J.

- 1. On manifolds homeomorphic to the 7-sphere. Annals of Math. 64 (1956), 399-405.
- 2. Topology from the Differentiable Viewpoint". University of Virginia Press, Charlottesville, 1966.
- 3. "Morse Theory". Annals of Math. Study 51 Princeton University Press, Princeton, 1963.

#### MOSER, J.

1. On a theorem of Anosov. J. Differential Equations 5 (1969), 411-440.

#### MUNKRES, J.

1. "Elementary differential topology". Annals of Math Study **54**, Princeton University Press, Princeton, 1963.

#### NELSON, E.

- 1. "Topics in Dynamics I: Flows". Princeton University Press, Princeton, 1969. NEMITSKII, V. V.
  - 1. Some modern problems in the qualitative theory of ordinary differential equations. Russian Math. Surveys 20 (1965), 1-34.

# NEMITSKII, V. V. and STEPANOV, V. V.

1. "Qualitative Theory of Ordinary Differential Equations". Princeton University Press, Princeton, 1960.

## NEWHOUSE, S. E.

- 1. Nondensity of Axiom A(a) on  $S^2$ . Global Analysis, 191–202.
- 2. Hyperbolic limit sets. Trans. Amer. Math. Soc. 167 (1972), 125-150.
- 3. On simple arcs between structurally stable flows. "Dynamical Systems—Warwick 1974". Springer Lecture Notes No. 468, pp. 209–233.

#### NEWHOUSE, S. E. and PALIS, J.

- 1. Hyperbolic nonwandering sets on two-dimension manifolds. *Dynamical Systems*, 293–301.
- 2. Bifurcations of Morse-Smale dynamical systems. *Dynamical Systems*, 303–366.
- 3. Cycles and bifurcation theory. Astérisque 31 (1976), 43–140.

# NEWHOUSE, S. E. and PEIXOTO, M.

1. There is a simple arc joining any two Morse-Smale flows. Astérisque 31 (1976), 15-41.

#### NITECKI, Z.

1. "Differentiable dynamics". MIT Press, Cambridge, Mass., 1971.

#### PALIS, J

- 1. A note on  $\Omega$ -stability. Global Analysis, 221–222.
- Some developments on stability and bifurcation of dynamical systems. "Geometry and Topology". Springer Lecture Notes No. 597, pp. 495-509 (1977).

#### PALIS, J. and SMALE, S.

1. Structural stability theorems. Global Analysis, 223–231.

#### PEIXOTO, M. M.

- 1. On an approximation theorem of Kupka and Smale. J. Differential Equations 3 (1966), 214–227.
- 2. Structural stability on two dimensional manifolds. *Topology* 1 (1962), 101-120
- 3. On the classification of flows on 2-manifolds. Dynamical Systems, 389-420.

#### PEIXOTO, M. and PUGH, C. C.

1. Structurally stable systems on open manifolds are never dense. *Annals of Math.* 87 (1968), 423-430.

# POINCARÉ, H.

1. Mémoire sur les courbes définies par une équation différentielle. *J. de Math.* 7 (1881) 375-422 and 8 (1882), 251-296. Sur les courbes définies par les équations différentielles. *J. de Math. Pure et Appl.* 1 (1885) 167-244. (These are all in Vol. 1 of "Oeuvres de Henri Poincaré". Gauthier-Villars, Paris, 1951.

## PUGH, C. C.

- 1. The closing lemma. Amer. J. Math. 89 (1967), 956-1009.
- 2. An improved closing lemma and a general density theorem. Amer. J. Math. 89 (1967), 1010-1021.
- 3. On a theorem of P. Hartman. Amer. J. Math. 91 (1969), 363-367.

#### PUGH, C. C. and SHUB, M.

1.  $\Omega$ -stability for flows. *Inventiones Math.* 11 (1970), 150–158.

#### RENZ. P. L.

1. Equivalent flows on Banach manifolds. *Indiana Univ. Math. J.* 20 (1971), 695-698.

#### ROBBIN, J. W.

1. A structural stability theorem. Annals of Math. 94 (1971), 447–493.

- 2. Topological conjugacy and structural stability for discrete dynamical systems. *Bull. Amer. Math. Soc.* **78** (1972), 923–952.
- ROBINSON, C.
  - 1. Generic properties of conservative systems. Amer. J. Math. 92 (1970), 562-603 and 897-906.
  - 2. Structural stability of C<sup>1</sup>-flows. "Dynamical Systems—Warwick 1974". Springer Lecture Notes No. 468, pp. 262–277.
  - 3. Structural stability of C<sup>1</sup>-diffeomorphisms. J. Differential Equations, 22 (1976), 28-73.
  - 4. The geometry of the structural stability proof using unstable discs. *Bol. Soc. Bras. Mat.* **6** (1975), 129–144.

# ROBINSON, C. and WILLIAMS, R. F.

1. Finite stability is not generic. Dynamical Systems, 451–462.

#### ROSENBERG, H.

1. A generalization of Morse-Smale inequalities. *Bull. Amer. Math. Soc.* **70** (1974), 422-427.

#### SHUB, M.

- 1. Structurally stable systems are dense. Bull. Amer. Math. Soc. 78 (1972), 817–818.
- Stability and genericity for diffeomorphisms. Dynamical Systems, 493– 514.
- 3. Dynamical systems, filtrations and entropy. Bull. Amer. Math. Soc. 80 (1974), 27-41.
- 4. Stabilité globale des systèmes dynamiques. Astérisque 56 (1978).
- 5. The Lefschetz fixed point formula: smoothness and stability. "Dynamical Systems" (Ed. Cesaro, L., Hale, J. K. and LaSalle, J. P.) pp. 13-28. Academic Press, New York, 1976.

#### SHUB, M. and SMALE, S.

1. Beyond hyperbolicity. *Annals of Math.* **96** (1972), 587–591.

#### SHUB, M. and WILLIAMS, R. F.

- 1. Future stability is not generic. *Proc. Amer. Math. Soc.* 22 (1969), 483–484. SIMMONS, G. F.
  - 1. "Differential Equations with Applications and Historical Notes". McGraw-Hill, New York, 1972.

#### SMALE, S.

- 1. On gradient dynamical systems. Annals of Math. 74 (1961), 199-206.
- 2. Generalized Poincaré's conjecture in dimensions greater than four. *Annals of Math.* **74** (1961), 391-406.
- 3. Stable manifolds for differential equations and diffeomorphisms. *Ann. Scuola Normale Superiore Pisa* 18 (1963), 97-116.
- 4. Structurally stable systems are not dense. Amer. J. Math. 88 (1966), 491–496.
- Differentiable dynamical systems. Bull. Amer. Math. Soc. 73 (1967), 747–817.
- 6. The  $\Omega$ -stability theorem. Global Analysis, 289–297.
- 7. Notes on differentiable dynamical systems. Global Analysis, 277–287.
- 8. Stability and genericity in dynamical systems. "Seminaire Bourbaki 1969–1970". Springer Lecture Notes No. 180, pp. 177–185 (1971).
- 9. Stability and isotopy in discrete dynamical systems. *Dynamical Systems*, 527-531.
- 10. On the structure of manifolds. *Amer. J. Math.* **84** (1962), 387–399.

## SOTOMAYOR, J.

- 1. Structural stability and bifurcation theory. Dynamical Systems, 549-560.
- 2. Generic bifurcations of dynamical systems. Dynamical Systems, 561-582.
- 3. Generic one-parameter families of vector fields on two-dimensional manifolds. Publ. Math. IHES 43 (1974), 5-46.

#### SPANIER, E. H.

1. "Algebraic topology". McGraw-Hill, New York, 1966.

# SULLIVAN, D. and WILLIAMS, R. F.

1. On the homology of attractors. *Topology* **15** (1976), 259–262.

#### STERNBERG, S.

- 1. Local contractions and a theorem of Poincaré. Amer. J. Math. 79 (1957), 809-824.
- 2. On the structure of local homeomorphisms of euclidean n-space; II. Amer. J. Math. 80 (1958), 623–631.

# TAKENS, F.

- 1. On Zeeman's tolerance stability conjecture. "Manifolds Amsterdam 1970". Springer Lecture Notes No. 197, pp. 209-219 (1971).
- 2. Tolerance stability. "Dynamical Systems—Warwick 1974". Springer Lecture Notes No. 468, pp. 293-304 (1975).
- 3. Integral curves near mildly degenerate singular points of vector fields. Dynamical Systems, 599-617.
- 4. Singularities of vector fields. Publ. Math. IHES 43 (1974), 47-100. THOM, R.

1. "Stabilité Structurelle et Morphogénèse". Addison-Wesley, Reading, Mass., 1973. (English translation by D. H. Fowler, 1975).

# WARNER, F. W.

1. "Foundations of Differentiable Manifolds and Lie Groups". Scott, Foresman, Glenview, Ill., 1971.

#### WELLS, J. C.

1. Invariant manifolds of nonlinear operators. Pacific J. Math. 62 (1976), 285-293.

#### WHITE, W.

1. On the tolerance stability conjecture. Dynamical Systems, 663-665.

#### WILLIAMS, R. F.

- 1. One dimensional non wandering sets. Topology 6 (1967), 473-487.
- 2. The "DA" maps of Smale and structural stability. Global Analysis, 329–339.
- 3. Expanding attractors. Publ. Math. IHES 43 (1974), 169-203.

#### ZEEMAN, E. C.

1. Morse inequalities for diffeomorphisms with shoes and flows with solenoids. "Dynamical Systems—Warwick 1974". Springer Lecture Notes No. 468, pp. 44-47 (1975).