References

[1] Amann, H. : Fixed point equations and nonlinear eigenvalue problems in ordered Banach spaces. SIAM Review **18** (1976),620-709.

[2] Amann, H. : Periodic solutions of semilinear parabolic equations. In : Cesari,L.,Kannan.R.,Weinberger,H.(eds.) Nonlinear Analysis. A collection of Papers in Honor of Erich Rothe. Academic Press, New York, 1978, pp. 1–29.

[3] Amann, H. : Ordinary Differential Equations. de Gruyter, Berlin, 1990.

[4] Anderson, R.M. : The dynamics and control of direct life cycle helminthic parasites. In : Barigozzi, C. (ed.) Vito Volterra Symposium on Mathematical Models in Biology. (Lecture Notes in Biomathematics, vol. 39.) Springer-Verlag, Berlin, Heidelberg, 1980.

[5] Anderson, R.M. : Directly transmitted viral and bacterial infections of man. In : Anderson, R.M. (ed.) Population Dynamics of Infectious Diseases. Theory and Applications. Chapman and Hall, New York, 1982, pp. 1–37.

[6] Anderson, R.M., May, R.M. : Population biology of infectious diseases. Part I, Nature **280** (1979), 361–367.

[7] Anderson, R.M., May, R.M. : Population biology of infectious diseases. Part II, Nature **280** (1979), 455–461.

[8] Anderson, R.M., May, R.M. : The population dynamics of microparasites and their invertebrate hosts. Trans. R. Philos. Soc. B, **291** (1981), 451–524.

[9] Anderson, R.M., May, R.M. : Infectious Diseases of Humans. Dynamics and Control. Oxford University Press, Oxford, 1991.

[10] Anderson, R.M., May, R.M., Medley, G.F., Johnson, A. : A preliminary study of the transmission dynamics of the human immunodeficiency virus (HIV), the causative agent of AIDS. IMA J. Math. Med. Biol. **3** (1986), 229–263.

[11] Anderson, D., Watson, R. : On the spread of a disease with gamma distributed latent and infectious periods. Biometrika **67** (1980), 191–198.

[12] Aris, R. : The Mathematical Theory of Diffusion and Reaction in Permeable Catalysts. Vols. I and II, Oxford Univ. Press, Oxford, 1975.

[13] Arnautu, V., Barbu, V., Capasso, V. : Controlling the spread of epidemics. Appl. Math. Optimiz. **20** (1989), 297–317.

[14] Aron, J.L., May, R.M. : The population dynamics of malaria. In : Anderson, R.M. (ed.) Population Dynamics of Infectious Diseases. Theory and Applications. Chapman and Hall, New York, 1982.

[15] Aronson, D.G. : The asymptotic speed of propagation of a simple epidemic. In : Fitzgibbon,W.E. and Walker, A.F. (eds.) Nonlinear Diffusion. Pitman, London, 1977.

[16] Aronson, D.G. : The role of diffusion in mathematical population biology : Skellam revisited. In : Capasso, V., Grosso, E. and Paveri-Fontana, S.L. (eds.) Mathematics in Biology and Medicine. (Lecture Notes in Biomathematics, vol. 57.) Springer-Verlag, Berlin, Heidelberg, 1985.

[17] Aronson, D.G., Weinberger, H.F. : Nonlinear diffusions in population genetics, combustion and nerve propagation. In : Goldstein, J. (ed.) Partial Differential

Equations and Related Topics. (Lecture Notes in Mathematics, vol. 446.) Springer-Verlag, Berlin, Heidelberg, 1975.

[18] Aronsson, G., Mellander, I. : A deterministic model in biomathematics: asymptotic behavior and threshold conditions. Math. Biosci. **49** (1980), 207–222.

[19] Bailey, N.T.J. : The Mathematical Theory of Infectious Diseases. Griffin, London, 1975.

[20] Bailey, N.T.J. : The Biomathematics of Malaria. Griffin, London, 1975.

[21] Banks, H.T., Mahaffy, J.M. : Global asymptotic stability synthesis and repression. Quart. Appl. Math. **36** (1978), 209–221.

[22] Barbour, A.D. : Macdonald's model and the transmission of bilharzia. Trans. Roy. Soc. Trop. Med. Hyg. **72** (1978), 6–15.

[23] Barbour, A.D. : Schistosomiasis. In : Anderson, R.M. (ed.) Population Dynamics of Infectious Diseases. Chapman and Hall, London, 1982.

[24] Basile, N., Mininni, M. : An extension of the maximum principle for a class of optimal control problems in infinite dimensional spaces. SIAM J. Control and Optimization **28** (1990),1113-1135.

[25] Basile, N., Mininni, M. : A vector valued optimization approach to the study of a class of epidemics. J. Math. Anal. Appl. **155** (1990),485-498.

[26] Belleni-Morante, A. : Applied Semigroups and Evolution Equations. Oxford University Press, Oxford, 1979.

[27] Bellman, R. : Introduction to Matrix Analysis. McGraw-Hill, New York, 1960.

[28] Beretta, E., Capasso, V. : On the general structure of epidemic systems. Global asymptotic stability. Comp. and Maths. with Appls. **12A** (1986), 677–694.

[29] Beretta, E., Capasso, V. : Global stability results for a multigroup SIR epidemic model. In : Gross L.J., Hallam T.G. and Levin S.A. (eds.) Mathematical Ecology. World Scientific, Singapore, 1988.

[30] Beretta, E., Capasso, V., Rinaldi, F. : Global stability results for a generalized Lotka-Volterra system with distributed delays. Application to predator-prey and to epidemic systems. J. Math. Biol. **26** (1988), 661–688.

[31] Berman, A., Plemmons, R.J. : Nonnegative Matrices in the Mathematical Sciences. Academic Press, New York, 1979.

[32] Bernoulli, D. : Essai d' une nouvelle analyse de la mortalité causée par la petite vérole et des avantages de l'inoculation pour la prévenir. Mem. Math. Phys. Acad. Roy. Sci., (1760), 1–45.

[33] Blat, J., Brown, K.J. : A reaction-diffusion system modelling the spread of bacterial infections. Math. Meth. Appl. Sci. **8** (1986), 234–246.

[34] Blythe, S.P., Anderson, R.M. : Distributed incubation and infectious periods in models of the transmission dynamics of the human immuno-deficiency virus (HIV). IMA J. Math. Med. Biol. **5** (1988), 1–19.

[35] Brauer, F. : Epidemic models in populations of varying population size. In: Castillo-Chavez, C., Levin, S.A. and Shoemaker C.A. (eds.) Mathematical Approaches to Problems in Resource Management and Epidemiology. (Lec-

ture Notes in Biomathematics, vol. 81.) Springer-Verlag, Berlin, Heidelberg, 1989, pp. 109–123.

[36] Brauer, F. : Some infectious disease models with population dynamics and general contact rates. Differential and Integral Equations, **3** (1990), 827–836.

[37] Brauer, F. : Models for the spread of universally fatal diseases. J. Math. Biol. **28** (1990), 451–462.

[38] Brauer, F., Nohel, J.A. : Qualitative Theory of Ordinary Differential Equations. Benjamin, New York, 1969.

[39] Britton, N.F., Reaction-Diffusion Equations and Their Applications to Biology. Academic Press, London, 1986.

[40] Busenberg, S., Cooke, K. : The Dynamics of Vertically Transmitted Diseases. To appear.

[41] Busenberg, S., Cooke, K., Iannelli, M. : Endemic thresholds and stability in a class of age-structured epidemics. SIAM J. Appl. Math. **48** (1988), 1379–1395.

[42] Busenberg, S.N., Iannelli, M., Thieme, H.R. : Global behavior of an age structured SIS epidemic model. Preprint U.T.M. **282**, Trento, 1989.

[43] Busenberg, S.N., Iannelli, M., Thieme, H.R. : Global behavior of an age structured SIS epidemic model. The case of a vertically transmitted disease. Preprint U.T.M. **308**, Trento, 1990.

[44] Busenberg, S., van den Driessche, P. : Analysis of a disease transmission model in a population with varying size. J. Math. Biol. **28** (1990), 257–270.

[45] Capasso, V. : Global solution for a diffusive nonlinear deterministic epidemic model. SIAM J. Appl. Math. **35** (1978), 274–284.

[46] Capasso, V. : Asymptotic stability for an integro-differential reaction- diffusion system. J. Math. Anal. Appl. **103** (1984), 575–588.

[47] Capasso, V. : A counting process approach for age-dependent epidemic systems. In : Gabriel, J.P., Lefevre, C. and Picard, P. (eds.) Stochastic Processes in Epidemic Theory. (Lecture Notes in Biomathematics, vol. 86.) Springer-Verlag, Berlin, Heidelberg, 1990, pp. 118–128.

[48] Capasso, V. : Mathematical modelling of transmission mechanisms of infectious diseases. An overview. In: Capasso, V. and Demongeot, J. (eds.) Proc. 1^{st} European Conference on Math. Appl. Biology and Medicine , 1992.To appear.

[49] Capasso, V., Di Liddo, A. : Global attractivity for reaction-diffusion systems. The case of nondiagonal diffusion matrices. J. Math. Anal. Appl. **177** (1993),510-529.

[50] Capasso, V., Di Liddo, A. : Asymptotic behaviour of reaction-diffusion systems in population and epidemic models. The role of cross diffusion. J. Math. Biol. **32** (1994),453-463.

[51] Capasso, V., Doyle, M. : Global stability of endemic solutions for a multigroup SIR epidemic model. SASIAM Technical Report, Bari (I), 1990.

[52] Capasso, V., Forte, B. : Model building as an inverse problem in Biomathematics. In : Levin, S.A. (ed.) Frontiers in Mathematical Biology. (Lecture Notes in Biomathematics, vol. 100.) Springer-Verlag, Berlin, Heidelberg, 1993, pp. 600–608.

[53] Capasso, V., Fortunato, D. : Stability results and their applications to some reaction-diffusion problems. SIAM J. Appl. Math. **39** (1979), 37–47.

[54] Capasso, V., Fortunato, D. : Asymptotic behavior for a class of non autonomous semilinear evolution systems and application to a deterministic epidemic model. Nonlinear Anal., T.M.A. **4** (1979), 901–908.

[55] Capasso, V., Kunisch, K. : A reaction diffusion system arising in modelling man-environment diseases. Quart. Appl. Math. **46** (1988), 431–450.

[56] Capasso, V., Maddalena, L. : Asymptotic behavior for a system of nonlinear diffusion equations diseases. Rend. Accad. Sc. Fis. e Mat. Napoli **48** (1981), 475–495.

[57] Capasso, V., Maddalena, L. : Convergence to equilibrium states for a reaction-diffusion system modelling the spatial spread of a class of bacterial and viral diseases. J. Math. Biol. **13** (1981), 173–184.

[58] Capasso, V., Maddalena, L. : Saddle point behavior for a reaction-diffusion system. Application to a class of epidemic models. Math. Comp. Simulation **24** (1982), 540–547.

[59] Capasso, V., Maddalena, L. : Periodic solutions for a reaction-diffusion system modelling the spread of a class of epidemics. SIAM J. Appl. Math. **43** (1983), 417–427.

[60] Capasso, V., Paveri-Fontana, S.L. : A mathematical model for the 1973 cholera epidemic in the European Mediterranean regions. Rev. Epidem. et Sante' Publ. **27** (1979), 121–132. Errata, ibid. **28** (1980), 330.

[61] Capasso, V., Serio, G. : A generalization of the Kermack-McKendrick deterministic epidemic model. Math. Biosci. **42** (1978), 41–61.

[62] Capasso, V., Thieme, H. : A threshold theorem for a reaction-diffusion epidemic system. In : Aftabizadeh, R. (ed.) Differential Equations and Applications. Ohio Univ. Press, 1988.

[63] Capasso, V., Thieme, H. : In preparation.

[64] Casten, R.G., Holland, C.J. : Stability properties of solutions to systems of reaction-diffusion equations. SIAM J. Appl. Math. **33** (1977), 353–364.

[65] Castillo-Chavez, C., Cooke, K.L., Huang, W., Levin, S.A. : On the role of long incubation periods in the dynamics of acquired immunodeficiency syndrome (AIDS). Part 1 : Single population models. J. Math. Biol. **27** (1989), 373–398.

[66] Castillo-Chavez, C., Cooke, K.L., Huang, W., Levin, S.A. : On the role of long incubation periods in the dynamics of acquired immunodeficiency syndrome (AIDS). Part 2 : Multiple group models. In : Castillo-Chavez, C. (ed.) Mathematical and Statistical Approaches to AIDS Epidemiology. (Lecture Notes in Biomathematics, vol. 83.) Springer-Verlag, Heidelberg, 1989.

[67] Castillo-Chavez, C., Cooke, K.L., Huang, W., Levin, S.A. : Results on the dynamics for models for the sexual transmission of the human immunodeficiency virus. Appl. Math. Lett. **2** (1989), 327–331.

[68] Chafee, N. : Behavior of solutions leaving the neighborhood of a saddle point for a nonlinear evolution equation. J. Math. Anal. Appl. **58** (1977), 312–325.

[69] Cliff, A.D., Haggett, P., Ord, J.K., Versey, G.R. : Spatial Diffusion. An Historical Geography of Epidemics in an Island Community. Cambridge University Press, Cambridge, 1981.

[70] Coale, A.J. : The Growth and Structure of Human Populations. A Mathematical Investigation. Princeton University Press, Princeton, N.J., 1972.

[71] Cooke, K.L., Yorke, J.A. : Some equations modelling growth processes and gonorrhea epidemics. Math. Biosci. **16** (1973), 75–101.

[72] Coppel, W.A. : Stability and Asymptotic Behavior of Differential Equations. D.C. Heath, Boston, 1965.

[73] Cross, G.W. : Three types of matrix stability. Linear Algebra Appl. **20** (1978), 253–263.

[74] Cunningham, J. : A deterministic model for measles : Z. Naturforsch. **34c** (1979), 647–648.

[75] Cushing, J.M. : Integrodifferential Equations and Delay Models in Population Dynamics. Lecture Notes in Biomathematics, vol. 20, Springer-Verlag, Berlin, Heidelberg, 1977.

[76] Cvjetanovic, B., Grab, B., Uemura, K. : Epidemiological model of typhoid fever and its use in the planning and evaluation of antityphoid immunization and sanitation programmes. Bull. W.H.O. **45** (1975), 53–75.

[77] De Angelis, D.L., Post, W.M., Travis, C.C. : Positive Feedback in Natural Systems, Springer-Verlag, Berlin, Heidelberg, 1986.

[78] Diekmann, O. : Thresholds and travelling waves for the geographical spread of infection. J. Math. Biol. **6** (1978), 109–130.

[79] Diekmann, O., Hesterbeek, H., Metz, J.A.J. : On the definition and the computation of the basic reproduction ratio R_0 in models for infectious diseases in heterogeneous populations. J. Math. Biol. **28** (1990), 365–382.

[80] Dietz, K. : Transmission and control of arbovirus diseases. In : Ludwig, D. and Cooke, K.L. (eds.) Epidemiology. SIAM, Philadelphia, 1975.

[81] Dietz, K. : The incidence of infectious diseases under the influence of seasonal fluctuations. Lecture Notes in Biomathematics, vol. 11, Springer-Verlag, Berlin, Heidelberg, 1976, pp. 1–15.

[82] Dietz, K., Hadeler, K.P. : Epidemiological models for sexually transmitted diseases. J. Math. Biol. **26** (1988), 1–25.

[83] Dietz, K., Schenzle, D. : Mathematical models for infectious disease statistics. In : Atkinson, A.C. and Fienberg, S.E. (eds.) A Celebration of Statistics. Springer-Verlag, New York, 1985, pp. 167–204.

[84] Dietz, K., Schenzle, D. : Proportionate mixing models for age-dependent infection transmission. J. Math. Biol. **22** (1985), 117–120.

[85] Driver, R.D. : Ordinary and Delay Differential Equations. Springer-Verlag, New York, 1977.

[86] Fife, P.C. : Mathematical Aspects of Reacting and Diffusing Systems. Lecture Notes in Biomathematics, vol. 28, Springer-Verlag, Berlin, Heidelberg, 1979.

[87] Fife, P.C., Mc Leod J.B. : The approach of solutions of nonlinear diffusion equations to travelling front solutions. Arch. Rat. Mech. Anal. **65** (1977), 335–361.

[88] Francis, D.P., Feorino, P.M., Broderson, J.R., McClure, H.M., Getchell, J.P., McGrath, C.R., Swenson, B., McDougal, J.S., Palmer, E.L., Harrison, A.K., Barre-Sinoussi, F., Chermann, J.C., Montagnier, L., Curran, J.W., Cabradilla, C.D., Kalyanaraman, V.S. : Infection of chimpanzees with lymphadenopathy-associated virus. Lancet **2** (1984), 1276–1277.

[89] Frauenthal, J.C. : Mathematical Modelling in Epidemiology. Springer-Verlag, Berlin, Heidelberg, 1980.

[90] Freedman, H.I. : Deterministic Mathematical Models in Population Ecology. Marcel Dekker, New York, 1980.

[91] Friedman, A. : Partial Differential Equations. Holt, Rinehart and Winston, New York, 1969.

[92] Gabriel, J.P., Hanisch, H., Hirsch, W.M. : Dynamic equilibria of helminthic infections. In : Chapman, D.G. and Gallucci, V.F. (eds.) Quantitative Population Dynamics. Int. Co-op. Pub. House, Fairland, Maryland, 1981, pp. 83–104.

[93] Gantmacher, F.R. : Applications of the Theory of Matrices. Interscience, New York, 1959.

[94] Goh, B.S. : Global stability in two species interactions. J. Math. Biol. **3** (1976), 313–318.

[95] Goh, B.S. : Global stability in many species systems. Am. Nat. **111** (1977), 135–143.

[96] Goh, B.S. : Global stability in a class of predator-prey models, Bull. Math. Biol. **40** (1978), 525–533.

[97] Grabiner, D. : Mathematical models for vertically transmitted diseases. In : Busenberg, S. and Cooke, K.L. (eds.) The Dynamics of Vertically Transmitted Diseases. Springer-Verlag, Heidelberg,1992.

[98] Greenhalgh, D. : Analytical results on the stability of age-structured recurrent epidemic models. IMA J. Math. Appl. Med. Biol. **4** (1987), 109–144.

[99] Greenhalgh, D. : Threshold and stability results for an epidemic model with an age-structured meeting rate. IMA J. Math. Appl. Med. Biol. **5** (1988), 81–100.

[100] Griffith, J.S. : Mathematics of cellular control processes, II. Positive feedback to one gene. J. Theoret. Biol. **20** (1968), 209–216.

[101] Gripenberg, G. : On a nonlinear integral equation modelling an epidemic in an age-structured population. J. reine angew. Math. **341** (1983), 54–67.

[102] Gupta, N.K., Rink, R.E. : Optimal control of epidemics. Math. Biosci. **18** (1973), 383–396.

[103] Hadeler, K.P. : Diffusion Equations in Biology. In: Iannelli, M. (ed.) Mathematics of Biology. CIME, Liguori Editore, Napoli, 1979.

[104] Hale, J.K. : Ordinary Differential Equations. Wiley-Interscience, New York, 1969.

[105] Hamer, W.H. : Epidemic diseases in England. Lancet **1** (1906), 733-739.

[106] Hassell, M.P., May, R.M. : The population biology of host-parasite and host-parasitoid associations. In : Roughgarden, J., May, R.M. and Levin S.A. (eds.) Perspectives in Ecological Theory. Princeton University Press, Princeton, 1989, pp. 319–347.

[107] Hastings, A. : Global stability in Lotka-Volterra systems with diffusion. J. Math. Biol. **6** (1978), 163–168.
[108] Henry, D. : Geometric Theory of Semilinear Parabolic Equations. Lecture Notes in Mathematics, vol. 840. Springer-Verlag, Berlin, Heidelberg, 1981.
[109] Hernandez, J. : Branches of positive solutions for a reaction-diffusion system modelling the spread of a bacterial infection. IRMA-CNR Report, Bari, 1989.
[110] Hethcote, H.W. : Qualitative analyses of communicable disease models. Math. Biosci. **28** (1976), 335–356.
[111] Hethcote, H.W., Levin, S.A. : Periodicity in epidemiological models. In: Gross, L., Hallam, T.G., and Levin, S.A. (eds.). Springer-Verlag, Heidelberg,1989, pp.193-211.
[112] Hethcote, H.W., Lewis, M.A., van der Driessche, P. : An epidemiological model with a delay and a nonlinear incidence rate. J. Math. Biol. **27** (1989), 49–64.
[113] Hethcote, H.W., Stech, H.W., van den Driessche, P. : Periodicity and stability in epidemic models : a survey. In : Busenberg S. and Cooke, K.L. (eds.) Differential Equations and Applications in Ecology, Epidemics and Population Problems. Academic Press, New York, 1981, pp. 65–82.
[114] Hethcote, H.W., Thieme, H.R. : Stability of the endemic equilibrium in epidemic models with subpopulations. Math. Biosci. **75** (1985), 205–227.
[115] Hethcote, H.W., van Ark, J.W. : Epidemiological models for heterogeneous populations : proportionate mixing, parameter estimation and immunization programs. Math. Biosci. **84** (1987), 85–118.
[116] Hethcote, H.W., van den Driessche, P. : Some epidemiological models with nonlinear incidence. J. Math. Biol. **29** (1991), 271–287.
[117] Hethcote, H.W., Waltman, P. : Optimal vaccination schedules in a deterministic epidemic model. Math. Biosci. **18** (1973), 365–381.
[118] Hethcote, H.W., Yorke, J.A. : Gonorrhea Transmission Dynamics and Control. Lecture Notes in Biomathematics vol. 56, Springer-Verlag, Berlin, Heidelberg, 1984.
[119] Hirsch, W.M. : The dynamical systems approach to differential equations. Bull. Am. Math. Soc. **11** (1984), 1–64.
[120] Holling, G.S. : Some characteristics of simple types of predation and parasitism. Can. Ent. **91** (1959), 385–398.
[121] Hoppensteadt, F. : Mathematical Theories of Populations : Demographics, Genetics and Epidemics. SIAM, Philadelphia, 1975.
[122] Huang, W. : Studies in Differential Equations and Applications. Ph.D. Dissertation, The Claremont Graduate School, Claremont (CA), 1990.
[123] Inaba, H. : Threshold and stability results for an age-structured epidemic model. J. Math. Biology **28** (1990), 411–434.
[124] Jacquez, J.A., Simon, C.P., Koopman, J.S. : The reproduction number in deterministic models of contagious diseases. Comments in Theoretical Biology **2** (1991), 159–209.
[125] Jacquez, J.A., Simon, C.P., Koopman, J.S., Sattenspiel, L., Parry, T. : Modeling and analyzing HIV transmission : the effect of contact patterns. Math. Biosci. **92** (1988), 119–199.

[126] Jordan, P., Webbe, G. : Human Schistosomiasis. Heineman, London, 1969.

[127] Kamke, E. : Zur Theorie der Systeme gewöhnlicher Differentialgleichungen, II, Acta Math. **58** (1932), 57–85.

[128] Kamke, E. : Differentialgleichungen: Lösungsmethoden und Lösungen I. Teubner, Stuttgart,1977.

[129] Kato, T. : Perturbation Theory for Linear Operators. Springer-Verlag, New York, 1966.

[130] Kendall, D.G. in discussion on "Bartlett, M.S., Measles periodicity and community size", J. Roy. Stat. Soc. Ser. A, **120** (1957), 48–70.

[131] Kendall, D. G. : Mathematical models of the spread of infection. In : Mathematics and Computer Science in Biology and Medicine. H.M.S.O., London, 1965, pp. 213–225.

[132] Kermack, W.O., McKendrick, A.G. : Contributions to the mathematical theory of epidemics.
- Part I, Proc. Roy. Soc., A, **115** (1927), 700–721,
- Part II, Proc. Roy. Soc., A, **138** (1932), 55–83,
- Part III, Proc. Roy. Soc., A, **141** (1933), 94–122,
- Part IV, J. Hyg. Camb. **37** (1937), 172–187,
- Part V, J. Hyg. Camb. **39** (1939), 271–288.

[133] Kolesov, Ju. S. : Certain tests for the existence of stable periodic solutions of quasilinear parabolic equations. Soviet Math. Doklady **5** (1964), 1118–1120.

[134] Kolesov, Ju. S. : Periodic solutions of quasilinear parabolic equations of second order. Trans. Moscow Math. Soc. **21** (1970), 114–146.

[135] Kolesov, Ju. S., Krasnoselskii, M.A. : Lyapunov stability and equations with concave operators. Soviet Math. Doklady **3** (1962), 1192–1196.

[136] Krasnoselskii, M.A. : Stability of periodic solutions emerging from an equilibrium state. Soviet Math. Doklady **4** (1963), 679–682.

[137] Krasnoselskii, M.A. : Positive Solutions of Operator Equations. Noordhoff, Groningen, 1964.

[138] Krasnoselskii, M.A. : The theory of periodic solutions of nonautonomous differential equations. Russian Math. Surveys **21** (1966), 53–74.

[139] Krasnoselskii, M.A. : Translation along Trajectories of Differential Equations. Transl. of Math. Monographs vol. 19, Am. Math. Soc., Providence, R.I., 1968.

[140] Kreyszig, E. : Introductory Functional Analysis with Applications. Wiley, New York, 1978.

[141] Kunisch, K., Schelch, H. : Parameter estimation in a special reaction- diffusion system modelling man-environment diseases. J. Math. Biol. **27** (1989), 633-665.

[142] Lajmanovich, A., Yorke, J.A. : A deterministic model for gonorrhea in a nonhomogeneous population. Math. Biosci. **28** (1976), 221–236.

[143] Lakshmikantham, V. : Comparison results for reaction-diffusion equations in a Banach space. Conf. Sem. Mat. Univ. Bari, **158–162** (1979), 121–156.

[144] Lange, J.M.A., Paul, D.A., Hinsman, H.G., deWolf, F., van den Berg, H., Coutinho, R.A., Danner, S.A., van der Noordaa, J., Goudsmit, H. : Persistent HIV antigenaemia and decline of HIV core antibodies associated with transmission of AIDS. Br. Med. J. **293** (1986), 1459–1462.

[145] LaSalle, J., Lefschetz, S. : Stability by Lyapunov's Direct Method, Academic Press, New York, 1961.

[146] Leung, A. W. : Limiting behavior for a prey-predator model with diffusion and crowding effects. J. Math. Biology, **6** (1978), 87–93.

[147] Leung, A. W. : Systems of Nonlinear Partial Differential Equations. Applications to Biology and Engineering. Kluwer Academic Publishers, Dordrecht, 1989.

[148] Levin, S.A. : Population models and community structure in heterogeneous environments. In : Levin, S.A. (ed.) Mathematical Association of America Study in Mathematical Biology. Vol. II : Populations and Communities. Math. Assoc. Amer., Washington, 1978, pp. 439–476.

[149] Levin, S.A. : Coevolution. In : Freedman, H.I. and Strobeck, C. (eds.) Population Biology. Lecture Notes in Biomathematics, Vol.52, Springer-Verlag, Heidelberg, 1983, pp. 328-324.

[150] Levin, S.A., Castillo-Chavez, C. : Topics in evolutionary theory. In : Mathematical and Statistical Developments of Evolutionary Theory. NATO Advanced Study Institute, Montreal, Canada, 1989.

[151] Levin, S.A., Pimentel, D. : Selection of intermediate rates of increase in parasite-host systems. Am. Nat. **117** (1981), 308–315.

[152] Levin, S.A., Segel, L.A. : Pattern generation in space and aspect. SIAM Rev. **27** (1985), 45–67.

[153] Lin, X. : Qualitative analysis of an HIV transmission model. Math. Biosci. **104** (1991), 111–134.

[154] Lin, X. : On the uniqueness of endemic equilibria of an HIV/AIDS transmission model for a heterogeneous population. J. Math. Biol. **29** (1991), 779–790.

[155] Liu, W.M., Hethcote, H.M., Levin, S.A. : Dynamical behavior of epidemiological models with nonlinear incidence rates. J. Math. Biol. **25** (1987), 359–380.

[156] Liu, W.M., Levin, S.A., Iwasa, Y. : Influence of nonlinear incidence rate upon the behavior of SIRS epidemiological models. J. Math. Biol. **23** (1986), 187–204.

[157] Longini, I.M.Jr., Scott Clark, W., Haber, M., Horsburgh, R.Jr. : The stages of HIV infection : waiting times and infection transmission probabilities. In : Castillo-Chavez, C. (ed.) Mathematical and Statistical Approaches to AIDS Epidemiology. (Lecture Notes in Biomathematics, vol. 83.) Springer-Verlag, Berlin, Heidelberg, 1989.

[158] Macdonald, G. : The Epidemiology and Control of Malaria. Oxford Univ. Press, Oxford, 1957.

[159] Macdonald, G. : The dynamics of helminthic infections, with special reference to schistosomes. Trans. Roy. Soc. Trop. Med. Hyg. **59** (1965), 489–504.

[160] Marek, I. : Frobenius theory of positive operators: comparison theorems and applications. SIAM J. Appl. Math. **19** (1970),607-628.
[161] Martin, R.H. Jr. : Asymptotic stability and critical points for nonlinear quasimonotone parabolic systems. J. Diff. Eqns. **30** (1978), 391– 423.
[162] Matano, H. : Asymptotic behavior and stability of solutions of semilinear diffusion equations. Publ. RIMS, Kyoto Univ. **15** (1979), 401– 454.
[163] May, R.M. : Population biology of microparasitic infections. In : Hallam T.G. and Levin S.A. (eds.) Mathematical Ecology. Springer-Verlag, Berlin, Heidelberg, 1986, pp. 405–442.
[164] May, R.M., Anderson, R.M. : Population biology of infectious diseases II. Nature **280** (1979), 455–461.
[165] May, R.M., Anderson, R.M., Mc Lean , A.R. : Possible demographic consequences of HIV/AIDS epidemics I. Assuming HIV infection always leads to AIDS. Math. Biosci. **90** (1988), 475–505.
[166] May, R.M., Anderson, R.M., Mc Lean, A.R. : Possible demographic consequences of HIV/AIDS epidemics II. Assuming HIV infection does not necessarily lead to AIDS. In : Castillo-Chavez, C., Levin, S.A. and Schoemaker, C.A. (eds.) Mathematical Approaches to Problems in Resource Management and Epidemiology. (Lecture Notes in Biomathematics vol. 81.) Springer-Verlag, Berlin, Heidelberg, 1989.
[167] McKendrick A. : Applications of mathematics to medical problems. Proc. Edinburgh Math. Soc. **44** (1926), 98–130.
[168] Metz, J.A.J., Diekmann, O. , Eds. : The Dynamics of Physiologically Structured Populations. Lecture Notes in Biomathematics, vol. 68. Springer-Verlag, Berlin, Heidelberg, 1986.
[169] Mora, X. : Semilinear parabolic problems define semiflows on C^k spaces. Trans. Am. Math. Soc. **278** (1983),21-55.
[170] Murray, J.D. : Nonlinear Differential Equation Models in Biology. Clarendon Press, Oxford, 1977.
[171] Murray, J.D. : Mathematical Biology. Springer-Verlag, Berlin, Heidelberg, 1989.
[172] Nåsell, I. : Mating models for schistosomes. J. Math. Biol. **6** (1978), 21–35.
[173] Nåsell, I. : Hybrid Models of Tropical Infections. Lecture Notes in Biomathematics, vol. 59. Springer-Verlag, Berlin, Heidelberg, 1985.
[174] Nåsell, I., Hirsch, W.M. : A mathematical model of some helminthic infections. Comm. Pure and Appl. Math. **25** (1972), 459–477.
[175] Nåsell, I., Hirsch, W.M. : The transmission dynamics of schistosomiasis. Comm. Pure and Appl. Math. **26** (1973), 395–453.
[176] Nold, A. : Heterogeneity in disease-transmission modeling. Math. Biosci. **52** (1980), 227–240.
[177] Okubo, A. : Diffusion and Ecological Problems : Mathematical Models. Springer-Verlag, Berlin, Heidelberg, 1980.
[178] Pao, C.V. : On nonlinear reaction-diffusion systems. J. Math. Anal. Appl. **87** (1982), 165–198.
[179] Pazy, A. : Semigroups of Linear Operators and Applications to Partial Differential Equations. Springer-Verlag, Berlin, Heidelberg, 1983.

[180] Piccinini, L.C., Stampacchia, G., Vidossich, G. : Differential Equations in $\mathbb{R}^n$. Springer-Verlag, Berlin, Heidelberg, 1984.

[181] Protter, M., Weinberger, H. : Maximum Principles in Differential Equations. Prentice-Hall, Englewood Cliffs, N.J., 1967.

[182] Pugliese, A. : Population models for diseases with no recovery. J. Math. Biol. **28** (1990), 65–82.

[183] Pugliese, A. : An SEI epidemic model with varying population size. Preprint U.T.M. **311**, Trento, 1990.

[184] Pugliese, A. : Stationary solutions of a multigroup model for AIDS with distributed incubation and variable infectiousness. Preprint U.T.M. **357**, Trento, 1991.

[185] Rauch, J., Smoller, J. : Qualitative theory of the FitzHugh- Nagumo equations. Adv. in Math. **27** (1978), 12–44.

[186] Redheffer, R. : Volterra Multipliers II. SIAM J. Alg. Discr. Math. **6** (1985).

[187] Redheffer, R.M., Walter, W. : On parabolic systems of the Volterra predator-prey type. Nonlinear Analysis, T.M.A. **7** (1983), 333– 347.

[188] Redheffer, R.M., Walter, W. : Solution of the stability problem for a class of generalized Volterra prey-predator systems. J. Diff. Equations **52** (1984), 245–263.

[189] Redheffer, R.M., Zhou, Z. : Global asymptotic stability for a class of many-variable Volterra prey-predator systems. Nonlinear Analysis, T.M.A. **5** (1981), 1309–1329.

[190] Redheffer, R.M., Zhou, Z. : A class of matrices connected with Volterra prey-predator equations. SIAM J. Alg. Discr. Math. **3** (1982), 122– 134.

[191] Ross, R. : The Prevention of Malaria. Murray, London, 1911.

[192] Rothe, F. : Convergence to the equilibrium state in the Volterra-Lotka diffusion equations. J. Math. Biol. **3** (1976), 319–324.

[193] Rushton, S., Mautner, A.J. : The deterministic model of a simple epidemic for more than one community. Biometrika **42** (1955), 126– 132.

[194] Salahuddin, S.Z., Markham, P.D., Redfield, R.R., Essex, M., Groopman, J.E., Sarngadharan, M.G., McLane, M.F., Sliski, A., Gallo, R.C. : HTLV-III in symptom-free seronegative persons. Lancet **2** (1984), 1418–1420.

[195] Sattenspiel, L., Simon, C.P. : The spread and persistence of infectious diseases in structured populations. Math. Biosci. **90** (1988), 341–366.

[196] Sattinger, D.H. : Monotone methods in nonlinear elliptic and parabolic boundary value problems. Indiana Math. J. **21** (1972), 979–1000.

[197] Schaefer, H.H. : Banach Lattices and Positive Operators. Springer- Verlag, Berlin, Heidelberg, 1974.

[198] Schenzle, D. : An age structural model of pre- and post-vaccination measles transmission. IMA J. Math. Appl. Biol. Med. **1** (1984), 169–191.

[199] Selgrade, J.F. : Mathematical analysis of a cellular control process with positive feedback. SIAM J. Appl. Math. **36** (1979), 219–229.

[200] Severo, N. C. : Generalizations of some stochastic epidemic models. Math. Biosci. **4** (1969), 395–402.

[201] Skellam, J.G. : Random dispersal in theoretical populations. Biometrika **38** (1951), 196–218.

[202] Smith, H.L. : Cooperative systems of differential equations with concave nonlinearities. J. Nonlin. Anal. T.M.A. **10** (1986), 1037–1052.
[203] Smith, H.L. : Systems of ordinary differential equations which generate an order preserving flow. A survey of results. SIAM Rev. **30** (1988), 87–113.
[204] Smoller, J. : Shock Waves and Reaction-Diffusion Equations. Springer-Verlag, Berlin, Heidelberg, 1983.
[205] Solimano, F., Beretta, E. : Graph theoretical criteria for stability and boundedness of predator-prey systems. Bull. Math. Biol. **44** (1982), 579–585.
[206] Takeuchi, Y., Adachi, N., Tokumaru, H. : The stability of generalized Volterra equations. J. Math. Anal. **62** (1978), 453–473.
[207] Thieme, H.R. : A model for the spatial spread of an epidemic. J. Math. Biol. **4** (1977), 337–351.
[208] Thieme, H.R. : Global asymptotic stability in epidemic models. In : Knobloch, H.W. and Schmitt, K. (eds.) Equadiff. (Lecture Notes in Mathematics, vol. 1017.) Springer-Verlag, Berlin, Heidelberg, 1983, pp. 608–615.
[209] Thieme, H.R. : Local stability in epidemic models for heterogeneous populations. In : Capasso, V., Grosso, E. and Paveri-Fontana, S.L. (eds.) Mathematics in Biology and Medicine. (Lecture Notes in Biomathematics, vol. 57.) Springer- Verlag, Berlin, Heidelberg, 1985, pp. 185–189.
[210] Verhulst, F. : Nonlinear Differential Equations and Dynamical Systems, Springer-Verlag, Heidelberg, 1990.
[211] Vogel, T. : Dynamique théorique et hérédité. Rend. Mat. Univ. Politec. Torino **21** (1961), 87–98.
[212] Volterra, V. : Sui tentativi di applicazione delle Matematiche alle Scienze Biologiche e Sociali. Giornale degli Economisti, Serie II, **23** (1901). Reprinted in : Volterra, V. : Saggi Scientifici. Zanichelli, Bologna, 1990.
[213] Volterra, V. : Leçons sur la Théorie Mathématique de la Lutte pour la Vie, Gauthier-Villars, Paris, 1931.
[214] von Foerster, H. : Some remarks on changing populations. In : Stohlman F. (ed.) The Kinetics of Cellular Proliferation. Grune and Stratton, New York, 1959, pp. 382–407.
[215] Walker, J.A. : Dynamical Systems and Evolution Equations. Theory and Applications. Plenum Press, New York, 1980.
[216] Waltman, P.: A Second Course in Elementary Differential Equations. Academic Press, Orlando, Fla., 1986.
[217] Wang, F.J.S. : Asymptotic behavior of some deterministic epidemic models. SIAM J. Math. Anal. **9** (1978), 529–534.
[218] Watson, R.K. : On an epidemic in a stratified population. J. Appl. Prob. **9** (1972), 659–666.
[219] Webb, G.F. : Compactness of bounded trajectories of dynamical systems in infinite dimensional spaces. Proc. Roy. Soc. Edinburgh, Sect. A, **84** (1979), 19–33.
[220] Webb, G.F. : Theory of Nonlinear Age-Dependent Population Dynamics. Marcel Dekker, New York, 1985.
[221] Williams, S., Chow, P.L. : Nonlinear reaction-diffusion models for interacting populations. J. Math. Anal. Appl. **62** (1978), 157–169.

[222] Wilson, E.B., Worcester, J. : The law of mass action in epidemiology.
- Part I, Proc. Nat. Acad. Sci., **31** (1945), 24–34,
- Part II, Proc. Nat. Acad. Sci., **31** (1945), 109–116.

[223] Wilson, H.K. : Ordinary Differential Equations. Addison-Wesley, Reading, Mass., 1971.

[224] Yang, G. : Contagion in stochastic models for epidemics. Annals of Math. Statistics **39** (1968), 1863–1889.

Notation

$\mathbb{N}$	$:= \{0, 1, 2, \cdots\}$ is the set of all natural numbers
$\mathbb{N}^*$	$:= \mathbb{N} - \{0\}$
$\mathbb{R}$	is the set of all real numbers
$\mathbf{C}$	is the set of all complex numbers
$\mathbb{R}_+$	$:= [0, +\infty)$ is the set of all nonnegative real numbers
$\mathbb{R}_+^*$	$:= \mathbb{R}_+ - \{0\} = (0, +\infty)$ is the set of all positive real numbers
$\mathbb{R}^n$	$:= \mathbb{R} \times \cdots \times \mathbb{R}$ (n times) is the n-dimensional Euclidean space
$\mathbb{K}$	$:= \mathbb{R}_+^n = \mathbb{R}_+ \times \cdots \times \mathbb{R}_+$ is the positive cone of the n-dimensional Euclidean space
$\mathbb{R}_+^{n*}$	$:= \mathbb{R}_+^* \times \cdots \times \mathbb{R}_+^*$ (n times) $= \overset{\circ}{\mathbb{K}}$
$\Vert \cdot \Vert$	denotes in general the Euclidean norm in $\mathbb{R}^n$, but it can also denote the norm in an arbitrary normed vector space (depending upon the context)
$B_\rho(z_0)$	$:= \{z \in E \mid \Vert z - z_0 \Vert < \rho\}$ denotes the open ball with center $z_0 \in E$ and radius $\rho > 0$ in a normed vector space E
A^T	denotes the transpose of the matrix A

Subject Index