



INTERNATIONAL ATOMIC ENERGY AGENCY
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION
INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS
I.C.T.P., P.O. BOX 586, 34100 TRIESTE, ITALY, CABLE: CENTRATOM TRIESTE



SMR.764 -5

RESEARCH WORKSHOP ON CONDENSED MATTER PHYSICS
13 JUNE - 19 AUGUST 1994

MINIWORKSHOP ON
"NONLINEAR TIME SERIES ANALYSIS"
8 - 12 AUGUST 1994

"Publications on Nonlinear Time Series Analysis"

Shu-yu ZHANG
The Institute of Physics
Chinese Academy of Sciences
P.O. Box 603
Beijing 100080
People's Republic of China

These are preliminary lecture notes, intended only for distribution to participants

MAIN BUILDING STRADA COSTIERA, 11 TEL. 22401 TELEFAX 224163 TELEX 460392 ADRIATICO GUEST HOUSE VIA GRIGNANO, 9 TEL. 224241 TELEFAX 224531 TELEX 460449
MICROPROCESSOR LAB. VIA BEIRUT, 31 TEL. 224471 TELEFAX 224600 TELEX 460392 GALILEO GUEST HOUSE VIA BEIRUT, 7 TEL. 22401 TELEFAX 2240310 TELEX 460392

Publications on Nonlinear Time Series Analysis

Compiled by Shu-yu Zhang
The Institute of Physics, Chinese Academy of Sciences
P. O. Box 603, Beijing 100080, China

The list is far from being complete. (B1992) indicates a Book published in 1992. Some books are included for containing one article on the subject. Numbers in parentheses are those in *Bibliography on Chaos*, World Scientific (1991), compiled by Zhang Shu-yu. Amendments are welcome to the above address.

1. Abarbanel H D I, Brown R, and Kadtke J B (1989) Prediction and system identification in chaotic nonlinear systems: time series with broadband spectra, *Phys. Lett.* 138A, 401-8.(4)
2. Abarbanel H D I, Brown R, and Kadtke J B (1990) Prediction in nonlinear systems: methods for time series with broadband Fourier spectra, *Phys. Rev.* A41, 1782-807.(5)
3. Abraham N B (1990) Methods for analyzing chaotic behavior and calculation of dimensions and entropies from experimental data, in *Laser Physics and Quantum Optics*, ed. L Narducci, E Quel and J R Tredicce, World Scientific. (32)
4. Abraham N B, Albano A M, Das B, de Guzman G, Yong S, Gioggia R S, Puccioni G P, and Tredicce J P (1986) Calculating the dimension of attractors from small data sets, *Phys. Lett.* 114A, 217-21.(38)
5. Abraham N B, Albano A M, Passamante A, and Rapp P E (B1990), eds., *Measures of Complexity and Chaos*, Plenum, x + 476.
6. Albano A M, Mees A I, de Guzman G C, and Rapp P E (1987) Data requirements for reliable estimation of correlation dimensions, in Degn, Holden and Olsen (B1987), 207-20.(162)
7. Albano A M, Mueuch J, Schwartz C, Mees A I, and Rapp P E (1988) Single-value decomposition and the Grassberger-Procaccia algorithm, *Phys. Rev.* A38, 3017-26.(163)
8. Albano A M, Passamante A, and Farrell M E (1992) Using high-order correlations to define an embedding window, *Physica* D58, 85.
9. Albano A M, Smilowitz L, Rapp P E, de-Guzman G C, and Bashore T R (1987) Dimension calculations in a minimal embedding space: low-dimensional attractors for Human electroencephalograms, *Lect. Notes in Phys.* 278.(164)
10. Alesic Z (1991) Estimating the embedding dimension, *Physica* D52, 362-8.
11. Arecchi F T, Basti G, Bocaletti S, and Perrone A L (1994) Adaptive recognition of a chaotic dynamics, *Europhys. Lett.* 26, 327-32.
12. Argoul F, Arneodo A, and Richetti P (1987) Experimental evidence for homoclinic chaos in the Belousov-Zhabotinskii reaction, *Phys. Lett.* 120A, 269-75.(350)
13. Argoul F, Arneodo A, and Richetti P (1990) Symbolic dynamics in the Belousov-Zhabotinskii reaction: an experimental and theoretical approach of Shilnikov homoclinic chaos, in *Spatial Inhomogeneities and Transient Behavior in Chemical Kinetics*, ed. Gray, Nicolis, Baras, Borckmans and Scott, Manchester Univ. Press, 57.(352)
14. Atmanspacher H (1988) Global scaling properties of a chaotic attractor reconstructed from experimental data, *Phys. Rev.* A37, 1314-22.(433)
15. Babloyantz A (1990) Some remarks on nonlinear data analysis of physiological time series, in Abraham, Albano, Passamante and Rapp (B1990), 51-62.(487)

16. Babloyantz A, and Destexhe A (1986) Low-dimensional chaos in an instance of epilepsy, *Proc. Natl. Acad. Sci. USA* 83, 3513-7.(489)
17. Badii R, Broggi G, Derighetti B, Ravani M, Ciliberto S, Politi A, and Rubio M A (1988) Dimension increase in filtered chaotic signals, *Phys. Rev. Lett.* 60, 979-82.(500)
18. Badii R, and Broggi G (1988) Measurement of the dimensions spectrum $f(\alpha)$: fixed mass approach, *Phys. Lett.* 131A, 339-43.(502)
19. Badii R, and Politi A (1984) Intrinsic oscillations in measuring the fractal dimension, *Phys. Lett.* 104A, 303-5.(508)
20. Badii R, and Politi A (1986) On the fractal dimension of filtered chaotic signals, in *Mayer-Kress (B1986)*, 57-73.(510)
21. Ben-Mizrachi A, Procaccia I, and Grassberger P (1984) Characterization of experimental (noisy) strange attractors, *Phys. Rev.* 29A, 975-7.(653)
22. Benettin G, Galgani L, and Strelcyn J-M (1976) Kolmogorov entropy and numerical experiments, *Phys. Rev.* A14, 2338-45.(676)
23. Bergé P (1982) Study of the phase-space diagrams through experimental Poincaré sections in pre-chaotic and chaotic regimes, *Phys. Scripta* T1, 71-2.(706)
24. Boyarsky A (1988) A matrix method for estimating the Liapunov exponent of one-dimensional systems, *J. Stat. Phys.* 50, 213-29.(1006)
25. Breeden J L, and Hübler A (1990) Reconstructing equations of motion from experimental data with unobserved variables, *Phys. Rev.* A42, 5817-26.(1032)
26. Breeden J L, and Packard N H (1992) Nonlinear analysis of data sampled nonuniformly in time, *Physics* D58, 273-83.
27. Briggs K (1990) An improved method for estimating Liapunov exponents of chaotic time series, *Phys. Lett.* 151A, 27.(1045)
28. Broggi G (1988) Evaluation of dimensions and entropies of chaotic systems, *J. Opt. Soc. Am.* 5B, 1020-8.(1059)
29. Broomhead D S, Jones R, and King G P (1987) Topological dimension and local coordinates from time series data, *J. Phys.* 20A, L563-9.(1068)
30. Broomhead D S, and Jones R (1989) Time series analysis, *Proc. R. Soc. Lond.* 423A, 101-21.(1070)
31. Broomhead D S, and King G P (1986a) Extracting qualitative dynamics from experimental data, *Physica* D20, 217-36.(1071)
32. Broomhead D S, and King G P (1986b) On the qualitative analysis of experimental dynamical systems, in *Sarkar (B1986)*, 113-44.(1072)
33. Brown R, Bryant P, and Abarbanel H D I (1991) Computing the Lyapunov spectrum of a dynamical system from an observed time series, *Phys. Rev.* A43, 2787-806.
34. Bryant P, Brown R, and Abarbanel H D I (1990) Lyapunov exponents from observed time series, *Phys. Rev. Lett.* 65, 1523-6. (1104)
35. Buzug Th, and Pfister G (1992) Comparison of algorithms calculating optimal embedding parameters for delay time coordinates, *Physica* D58, 127-37.
36. Caputo J G, Malraison B, and Atten P (1986) Determination of attractor dimension and entropy for various flows: an experimentalist's viewpoint, in *Mayer-Kress (B1986)*, 180-90. (1185)
37. Caputo J G, and Atten P (1987) Metric entropy: an experimental means for characterizing and quantifying chaos, *Phys. Rev.* A35, 1311-6.(1186)
38. Casdagli M (1989) Nonlinear prediction of chaotic time series, *Physica* D35, 335-56.(1262)

39. Casdagli M, and Eubank S (B1992), eds., *Nonlinear Modeling and Forecasting*, Santa Fe Institute Studies in the Science of Complexity, Proc. vol. XII, Addison-Wesley.
40. Casdagli M, des Jardins D, Eubank S, Farmer J D, Gibson J, Theiler J, and Hunter N (1992) Nonlinear modeling of chaotic time series: theory and applications, in *Applied Chaos*, ed. J. H. Kim and J. Stringer, Wiley, 335.
41. Casswell W E, and Yorke J A (1986) Invisible errors in dimension calculations: geometric and systematic effects, in Mayer-Kress (B1986), 123-36.(1263)
42. Cawley R, and Hsu G H (1992a) A local geometric projection method for noise reduction in maps and flows, *Phys. Rev.* **A46**, 3057-62.
43. Cawley R, and Hsu G H (1992b) SNR performance of a noise reduction algorithm applied to coarsely sampled chaotic data, *Phys. Lett.* **A166**, 188.
44. Chen Z-M (1993) A note on Kaplan-Yorke-type estimates on the fractal dimension of chaotic attractors, *Chaos, Solitons & fractals* **3**, 575-82.
45. Chennaoui A, Libler J, and Schuster H G (1990) The mechanism of the increase of the generalized dimension of a filtered chaotic time series, *J. Stat. Phys.* **59**, 1311. (1354)
46. Chennaoui A, Pawelzik K, Libert W, Schuster H G, and Pfister G (1990) Attractor reconstruction from filtered chaotic time series, *Phys. Rev.* **41A**, 4151-9.(1355)
47. Conte R, and Dubois M (1988) Lyapunov exponents of experimental systems, in Leon (B1988), 767-80.(1507)
48. Cremers J, and Hübner A (1987) Construction of differential equations from experimental data, *Z. Naturforsch.* **42a**, 797-802.(1564)
49. Crutchfield J P, and McNamara B S (1987) Equations of motion from a data series, *Complex Sys.* **1**, 417-52.(1599)
50. Crutchfield J P, and Packard N H (1982) Symbolic dynamics of one-dimensional maps: entropies, finite precision, and noise, *Int. J. Theor. Phys.* **21**, 433-66.(1600)
51. Das B, Albano A M, and Abraham N B (1990) Correlation-dimension calculations for broadband intensity fluctuations in emission from a heavily saturated source of amplified spontaneous emission, *Phys. Rev.* **41A**, 6162-75.(1684)
52. Davies M (1993) Noise reduction by gradient descent, *Chaos, Solitons & Chaos* **3**, 113-8.
53. Davies M E (1992) An iterated function approximation in shadowing time series, *Phys. Lett.* **A169**, 251-8.
54. Degn H, Holden A V, and Olsen L F (B1987), eds., *Chaos in Biological Systems*, NATO ASI Series A128, Plenum, xi + 323.
55. Denker M, and Keller G (1986) Rigorous statistical procedures for data from dynamical systems, *J. Stat. Phys.* **44**, 67.(1782)
56. Deppisch J, Bauer H-U, and Geisel T (1991) Hierarchical training of neural networks and prediction of chaotic time series, *Phys. Lett.* **A158**, 37.
57. Destexhe A (1990) Symbolic dynamics from biological time series, *Phys. Lett.* **A143**, 373-8; Erratum **A147**, 528.(1797)
58. Destexhe A, Nicolis G, and Nicolis C (1990) Symbolic dynamics from chaotic time series, in Abraham, Albano, Passamante and Rapp (B1990).(1798)
59. Destexhe A, Sepulchre J A, and Babloyantz A (1988) A comparative study of the experimental quantification of deterministic chaos, *Phys. Lett.* **132A**, 101-6.(1799)
60. Donaldson G C (1992) The chaotic behavior of resting human respiration, *Respir. Physiol.* **88**, 313-21.

61. Drazin P G, King G P (B1992), eds., *Interpretation of Time Series from Nonlinear Systems*, Proceedings of the IUTAM Symposium and NATO Advanced Research Workshop, *Physica D***58**, xiv + 505.
62. Duong-Van M (B1987), ed., *Chaos'87. International Conference on the Physics of Chaos and Systems Far from Equilibrium*, *Nucl. Phys. B*, Proc. Suppl. **2**.
63. Dvorak I, and Klaschka J (1990) Modification of the Grassberger-Procaccia algorithm for estimating the correlation exponent of chaotic systems with high embedding dimension. *Phys. Lett.* **145A**, 225.(1946)
64. Dvorak I, and Siska J (1986) On some problems encountered in the estimation of the correlation dimension of the EEG, *Phys. Lett.* **118A**, 63-6.(1947)
65. Eckmann J P, Oliffson Kamphorst S, Ruelle D, and Ciliberto S (1986) Liapunov exponents from time series, *Phys. Rev.* **A34**, 4971-9.(1972)
66. Eckmann J P, Oliffson Kamphorst S, and Ruelle D (1987) Recurrence plots of dynamical systems, *Europhys. Lett.* **4**, 973-7.(1973)
67. Eckmann J P, and Ruelle D (1985) Ergodic theory of chaos and strange attractors, *Rev. Mod. Phys.* **57**, 617-56; Addendum **57**, 1115.(1979)
68. Eckmann J P, and Ruelle D (1992) Fundamental limitations for estimating dimensions and Lyapunov exponents in dynamical systems, *Physica D***56**, 185.
69. Elgar S, and Chandran V (1993) Measured time series and an application to Chua's circuit, *Int. J. Bif. & Chaos* **3**, 19-34.
70. Ellner S (1988) Estimating attractor dimensions from limited data: a new method, with error estimates, *Phys. Lett.* **A133**, 128-33.(3359)
71. Ellner S (1991) Detecting low-dimensional chaos in population dynamics data: a critical review, in Logan and Hain (B1991), 65-92.
72. Ellner S, Gallant A R, McCaffery D, and Nychka (1991) Convergence rates and data requirements for Jacobian-based estimates of Lyapunov exponents from data, *Phys. Lett.* **A153**, 357-63.
73. Elsner J B, and Tsonis A A (1992) Nonlinear prediction, chaos, and noise, *Bull. AAMS* **73**, 49-60.
74. Enge N, Buzug Th, and Pfister G (1993) Noise reduction on chaotic attractors, *Phys. Lett.* **A172**, 178-86.
75. Eubank S G, and Farmer D (1990) An introduction to chaos and randomness, in *1989 Lectures in Complex Systems*, ed. by E. Jen, Addison-Wesley, 75-190.
76. Farmer J D (1991) Optimal shadowing and noise reduction, *Physica D***47**, 373-92.
77. Farmer J D, Ott E, and Yorke J A (1983) The dimension of chaotic attractors, *Physica D***7**, 153-80.(2096)
78. Farmer J D, and Sidorowich J J (1987) Predicting chaotic time series, *Phys. Rev. Lett.* **59**, 845-8.(2098)
79. Farmer J D, and Sidorowich J J (1988) Exploiting chaos to predict the future, in *Evolution, Learning, and Cognition*, ed. Y C Lee, World Scientific, 277.(2099)
80. Farmer J D, and Sidorowich J J (1991) Optimal shadowing and noise reduction, *Physica D***47**, 373-92.
81. Fowler A C, and Kember G (1993) Delay recognition in chaotic time series, *Phys. Lett.* **A175**, 402-8.
82. Fraedrich K (1986) Estimating the dimension of weather and climate attractors, *J. Atmos. Sci.* **43**, 419-32.(2229)

83. Fraedrich K (1987) Estimating weather and climate predictability on attractors, *J. Atmos. Sci.* 44, 722-8.(2230)
84. Fraedrich K, and Wang R (1993) Estimating the correlation dimension of an attractor from noisy and small datasets based on re-embedding, *Physica* **D65**, 373.
85. Frank G W, Lookman T, Nerenberg M A H, Essex C, Lemieux J, and Blume W (1990) Chaotic time series analysis of epileptic seizures, *Physica* 46D, 427.(2250)
86. Fraser A M (1989a) Reconstructing attractors from scalar time series: a comparison of singular system and redundancy criteria, *Physica* 34D, 391-404.(2253)
87. Fraser A M (1989b) Information and entropy in strange attractors, *IEEE Trans. Inform. Theory* 35, 245-62.(2254)
88. Fraser A M, and Swinney H L (1986) Independent coordinates for strange attractors from mutual information, *Phys. Rev.* A33, 1134-40.(2256)
89. Frederickson P, Kaplan J L, Yorke E D, and Yorke J A (1983) The Liapunov dimension of strange attractors, *J. Diff. Eq.* 49, 185-207.(2264)
90. Froehling H, Crutchfield J P, Farmer J D, Packard N H, and Shaw R (1981) On determining the dimension of chaotic flows, *Physica* 3D, 605-17.(2291)
91. Gallez D, and Babloyantz A (1991) Predictability of human EEG: a dynamical approach, *Biol. Cybern.* 64, 381-91.
92. Gencay R, and Dechert W D (1992) An algorithm for the n Lyapunov exponents of an n -dimension unknown dynamical system, *Physica* D59, 142-57.
93. Gershenfeld N A (1988) An experimentalist's introduction to the observation of dynamical systems, in Hao (B1988), 310-84.(2441)
94. Gershenfeld N A (1992) Dimension measurement on high-dimensional systems, *Physica* D55, 135-54.
95. Ghil M, Benzi R, and Parisi G (1985), eds., *Turbulence and Predictability in Geophysical Fluid Dynamics and Climate Dynamics*, North-Holland.
96. Giona M, Lentini F, and Cimagalli V (1991) Functional reconstruction and local prediction of chaotic time series, *Phys. Rev.* **A44**, 3496-502.
97. Giorgilli A, Casati G, Sironi L, and Galgani L (1986) An efficient procedure to compute fractal dimensions by box counting, *Phys. Lett.* 115A, 202-6.(2469)
98. Glazier J A (1989) Chaos and the analysis of experimental data, in Turchetti (B1989), 250-61.(2494)
99. Göber M, Herzel H, and Graf H (1992) Dimension analysis of El Nino - Southern oscillation time series, *Ann. Geophys.* 10, 729.
100. Gouesbet G, and Maquet J (1992) Construction of phenomenological models from numerical scalar time series, *Physica* **D58**, 202-15.
101. Grassberger P (1983) Generalized dimensions of strange attractors, *Phys. Lett.* 97A, 227-30.(2642)
102. Grassberger P (1985a) Information flow and maximum entropy measures for one-dimensional maps, *Physica* 14D, 365-73.(2645)
103. Grassberger P (1985b) Generalizations of the Hausdorff dimension of fractal measures, *Phys. Lett.* 107A, 101-5.(2646)
104. Grassberger P (1986) Estimating the fractal dimensions and entropies of strange attractors, *IEEE Trans. Inform. Theory* 35, 669-75; and in Holden (B1986), 291-311.(2651)
105. Grassberger P (1988) Finite sample corrections to entropy and dimension estimates, *Phys. Lett.* 128A, 369-71.(2654)

106. Grassberger P (1989) Information content and predictability of lumped and distributed dynamical systems, *Phys. Scripta* 40, 346-53.(2655)
107. Grassberger P (1990) An optimized box-assisted algorithm for fractal dimensions, *Phys. Lett.* 148A, 63.(2660)
108. Grassberger P, Hegger R, Kantz H, Schaffrath C, and Schreiber T (1993) On noise reduction methods for chaotic data, *Chaos (AIP)* 3, 127-41.
109. Grassberger P, Schreiber T, and Schaffrath C (1991) Nonlinear time sequence analysis, *Int. J. Bifur. & Chaos* 1, 521-47.
110. Grassberger P, and Procaccia I (1983a) Measuring the strangeness of strange attractors, *Physica* 9D, 189-208.(2665)
111. Grassberger P, and Procaccia I (1983b) On the characterization of strange attractors, *Phys. Rev. Lett.* 50, 346-9.(2666)
112. Grassberger P, and Procaccia I (1983c) Estimation of the Kolmogorov entropy from a chaotic signal, *Phys. Rev.* A28, 2591-3.(2667)
113. Grebogi C, Ott E, and Yorke J A (1988) Roundoff-induced periodicity and the correlation dimension of chaotic attractors, *Phys. Rev.* A38, 3688-92.(2698)
114. Green M L, and Savit R (1991) Dependent variables in broadband continuous time series, *Physica* D50, 521-44.
115. Greenside H S, Wolf A, Swift J, and Pignataro T (1982) Impracticality of a box-counting algorithm for calculating the dimensionality of strange attractors, *Phys. Rev.* A25, 3453-6.(2717)
116. Guckenheimer J, and Buzyna G (1983) Dimension measurements for geostrophic turbulence, *Phys. Rev. Lett.* 51, 1438-41.(2798)
117. Halsey T C, Jensen M H, Kadanoff L P, Procaccia I, and Shraiman B I (1986) Fractal measures and their singularities: the generalization of strange sets, *Phys. Rev.* A33, 1141-51; Erratum A34, 1601.(2912)
118. Halsey T C, Jensen M H, Kadanoff L P, Procaccia I, and Shraiman B I (1987) Fractal measures and their singularities: the characterization of strange sets, *Nucl. Phys. Proc. Suppl.* B2, 501-11.(2913)
119. Hammel S M (1989) A noise reduction method for chaotic systems, *Phys. Lett.* 148A, 421.(2918)
120. Hao B-L (B1987), ed., *Directions in Chaos*, vol. 1, World Scientific, xi + 353.
121. Hao B-L (B1988), ed., *Directions in Chaos*, vol. 2, World Scientific, xiii + 384.
122. Hao B-L (B1990), ed., *Experimental Study and Characterization of Chaos*, vol. 3 of *Directions in Chaos*, World Scientific, vii+590.
123. Hao B-L (1991) Symbolic dynamics and characterization of complexity, *Physica* D51, 161-176.
124. Havstad J W, and Ehlers C L (1989) Attractor dimension of nonstationary dynamical systems from small data sets, *Phys. Rev.* A39, 845-53.(2996)
125. Hediger T, Passamante A, and Farrell M E (1990) Characterizing attractors using local intrinsic dimensions calculated by singular-value decomposition and information-theoretical criteria, *Phys. Rev.* A41, 5325.(3026)
126. Herzel H, Kurths J, Landa P S, and Rosenblum M G (1989) New aspects of detecting chaos in a time series, in *Irreversible Processes and Selforganization*, Teubner-Verlag Leipzig.(3094)
127. Higuchi T (1990) Relationship between the fractal dimension and the power law index for a time series: a numerical investigation, *Physica* D46, 254.(3112)

128. Hinich M J (1982) Testing for Gaussianity and linearity of a stationary time series, *J. Time Series Anal.* **3**, 169-76.
129. Holden A V (B1986), ed., *Chaos*, Manchester University Press.
130. Holzfuss J, and Lauterborn W (1989) Liapunov exponents from a time series of acoustic chaos, *Phys. Rev.* **A39**, 2146-52.(3223)
131. Holzfuss J, and Mayer-Kress G (1986) An approach to error-estimation in the application of dimension algorithms, in Mayer-Kress (B1986), 114-22.(3224)
132. Hsieh D A (1991) Chaos and nonlinear dynamics: application to financial markets, *J. Finance* **46**, 1839-77.
133. Hu P, Yang P-C, Li W, and Zhao M (1990) A study of the dynamics and predictability of the earthquake processes, *Acta Geophys. Sinica* **33**, 647-55 (in Chinese).(3287)
134. Hübner U, Abraham N B, and Weiss C O (1989a) Characterization of periodic and chaotic intensity pulsation of a Lorenz-like FIR NH₃ laser, *Phys. Rev.* **A39**, 6354-65.(3306)
135. Hübner U, Abraham N B, and Weiss C O (1989b) Dimensions and entropies of chaotic intensity pulsations in a single mode far-infrared NH₃ laser, *Phys. Rev.* **A40**, 6354-65.
136. Hübner U, Klische W, Abraham N B, and Weiss C O (1990) On problems encountered with dimension calculations, in Abraham, Albano, Passamante and Rapp (B1990).(3307)
137. Hübner U, Klische W, and Weiss C O (1992) Generalized dimensions of laser attractors, *Phys. Rev.* **A45**, 2128-30.
138. Hunt F, and Sullivan F E (1986) Efficient algorithms for computing fractal dimensions, in Mayer-Kress (B1986), 74-81. (3328)
139. Ilkova L Sh, Kravtsov Ju A, and Pikovsky A S (1986) Identifying the degree of determinism of experimentally observed chaotic modes, *Sov. Phys. Lebedev Inst. Rep.* **11**, 7-11; *Russ. Orig.* **11**, 7-9.(3358)
140. Jansen B H, and Brandt M E (B1993), eds., *Nonlinear Dynamical Analysis of the EEG*, World Scientific.
141. Kantz H (1993) Noise reduction by local reconstruction of the dynamics, in Weigend and Gershenfeld (B1993), 475-90.
142. Kaplan D T (1992) Geometrical techniques for analysing ECG dynamics, *J. Electrocardiology* **24**, 77-82.
143. Kaplan D T (1993) A geometrical statistics for detecting deterministic dynamics, in Weigend and Gershenfeld (B1993), 415-28.
144. Kaplan D T, and Glass L (1992) A direct test for determinism in a time series, *Phys. Rev. Lett* **68**, 427-30.
145. Kaplan D T, and Glass L (1993) Coarse-grained embeddings of time series: random walks, Gaussian random processes, and deterministic chaos, *Physica D* **64**, 431-54.
146. Keenan D M (1985) A Tukey nonadditivity-type test for time series nonlinearity, *Biometrika* **72**, 39-44.
147. Kelso J A S, Mandell A J, and Schlesinger M F (B1988), eds., *Dynamic Patterns of Complex Systems*, World Scientific.
148. Kennel M B, Brown R, and Abarbanel H D I (1992) Determining minimum embedding dimension using a geometrical construction, *Phys. Rev.* **A45**, 3403-11.
149. Kennel M B, and Isabelle S (1992) Method to distinguish possible chaos from colored noise and to determine embedding parameters, *Phys. Rev.* **A46**, 3111-8.
150. King G P, Jones R, and Broomhead D S (1987) Phase portrait from a time series: a singular system approach, in Duong-Van (B1987), 379-90.(3723)

151. King G P, and Stewart I (1992) Phase space reconstruction for symmetric dynamical systems, *Physica* **D58**, 216-28.
152. Kohda T, and Murao K (1990) Approach to time series analysis for one-dimensional chaos based on Frobenius-Perron operator. Trans. IECE Japan J73-A, 793-800.(3804)
153. Kostelich E J (1990) Noise reduction: finding the simplest dynamical system consistent with the data, *Physica* **D41**, 183-96.
154. Kostelich E J (1992) Problems in estimating dynamics from data, *Physica* **D58**, 138-52.
155. Kostelich E J, and Lathrop D P (1993) Time series prediction using the method of analogues, in Weigend and Gershenfeld (B1993), 283-95.
156. Kostelich E J, and Swinney H L (1989) Practical considerations in estimating dimension from the time series data, *Phys. Scripta* 40, 436-41. (3846)
157. Kostelich E J, and Yorke J A (1988a) Noise reduction in dynamical systems, *Phys. Rev. A* 38, 1649-52.(3849)
158. Kostelich E J, and Yorke J A (1988b) Using dynamic embedding methods to analyze experimental data, in Nicolaenko, Foias and Temam (B1989), 307-12.(3850)
159. Kostelich E J, and Yorke J A (1990) Noise reduction: finding the simplest dynamical system consistent with the data, *Physica* **D41**, 183-96. (3851)
160. Kravtsov Yu A (B1993), ed., *Limits of Predictability*, vol. 60 in Springer Series in Synergetics, Springer-Verlag, xii + 252.
161. Krishna Mohan T R, Subba Rao J, and Ramaswamy R (1989) Dimension analysis of climatic data, *J. Climate* 2, 1047-57.(3870)
162. Kube M C, Pride S T, and Hudson J L (1993) Local analysis of time series from the oscillatory electrocatalytic reduction of hydrogen peroxide, *Chaos, Solitons & Chaos* **3**, 495-507.
163. Kurths J, and Herzel H (1987) An attractor in a solar time series, *Physica* **D25**, 165-72.(3903)
164. Lafon A, Rossi A, and Vidal C (1983) The power of chaos measured through the spectral analysis of experimental data, *J. de Phys.* 44, 505.(3927)
165. Lam L, and Morris H C (B1990), eds., *Nonlinear Structures in Nonlinear Systems: Pattern Formation, Chaos and Waves*, Springer-Verlag.
166. Landa P S, and Chetverikov V I (1988) On the evaluation of the maximum Lyapunov exponent from a single experimental time series, *Sov. Phys. Tech. Phys.* 33, 263-8.(3938)
167. Lathrop D, and Kostelich E J (1989) Characterization of an experimental strange attractor by periodic orbits, *Phys. Rev. A* 40, 4028-31.(3978)
168. Lathrop D, and Kostelich E J (1990) Analyzing periodic saddles in experimental strange attractors, in Abraham, Albano, Passamante and Rapp (B1990).(3979)
169. Layne S P, Mayer-Kress G, and Holzfuss J (1986) Problems associated with dimensional analysis of electroencephalogram data, in Mayer-Kress (B1986), 246-56.(3999)
170. Lefebvre J H, Goodings D A, Kamath M V, and Fallen E L (1993) Predictability of normal heart rhythms and deterministic chaos, *Chaos (AIP)* **3**, 267-76.
171. Legras B, and Ghil M (1983) Blocking and variation in atmospheric predictability, in *Predictability of Fluid Motions*, ed. G Holloway and B J West, AIP.(4032)
172. Leon J J P (B1988), ed., *Nonlinear Evolutions*, World Scientific.
173. Leven R W, and Uhrlandt D (1992) Estimation of the $f(\alpha)$ spectrum from simulated and measured time series, *Chaos, Solitons & Fractals* **2**, 471-85.
174. Liebert W, Pawelzik K, and Schuster H G (1991) Optimal embeddings of chaotic attractors from topological considerations, *Europhys. Lett.* 14, 521-6.

175. Liebert W, and Schuster H G (1989) Proper choice of the time delay for the analysis of chaotic time series, *Phys. Lett.* **A142**, 107-11.
176. Liebovitch L S, and Toth T (1989) A fast algorithm to determine fractal dimension by box counting, *Phys. Lett.* **A141**, 386-90.
177. Linsay P S (1991) An efficient method of forecasting chaotic time series using linear interpolation, *Phys. Lett.* **A153**, 353-6.
178. Liu S-D (1988) Computation of Lyapunov exponent and fractal dimension by using atmospheric turbulent data, *Acta Meteorol. Sinica* 46, 41-8 (in Chinese).(4176)
179. Logan J A, and Hain F P (B1991), eds., *Chaos and Insect Ecology*, University of Virginia Press, Blacksburg.
180. Abarbanel H D I, Brown R, and Kadtke J B (1989) Prediction and system identification in chaotic nonlinear systems: time series with broadband spectra, *Phys. Lett.* 138A, 401-8.(4)
181. Lorenz E N (1991) Dimension of weather and climate attractors, *Nature* 353 (19), 241-244.
182. Lorenz H-W (1985) Some remarks on chaos, econometric predictability and rational expectations, in *Dynamische Eigenschaften nichtlinearer Differenzgleichungen und ihre Anwendungen in der Ökonomie*, ed. G Gabisch and H von Trothe, GMD-Studien 97.(4213)
183. MacKay R S (1987) Rotation interval from a time series, *J. Phys.* A20, 587-92.(4264)
184. Mainieri R (1993) On the equality of Hausdorff and box counting dimensions, *Chaos* (AIP) **3**, 119-25.
185. Malinetskii G G, Potapov A B, Gizzatulina S H, Ruzmaikin A A, and Rukavishnikov V D (1990) Dimension of a geomagnetic attractor from data on length of daily variation, *Phys. Earth & Planet. Inter.* **59**, 170-81.
186. Malraison B, Atten P, Bergé P, and Dubois M (1983) Dimension of strange attractors: an experimental determination for the chaotic regime of two convective systems, *J. Physique Lett.* 44, L897-902.(4321)
187. Markus M, and Hess B (1985) Dimension and Lyapunov exponents of a strange attractor from biochemical data, in Rensing and Jaeger (B1985), 191-3.
188. Marteau P F, and Abarbanel H D I (1991) Noise reduction in chaotic time series using scaled probabilistic methods, *J. Nonlinear Sci.* **1**, 313.
189. Mayer-Kress G (1987) Application of dimension algorithms to experimental chaos, in Hao (B1987), 122-47.(4503)
190. Mayer-Kress G (B1986), ed., *Dimensions and Entropies in Chaotic Systems. Quantification of Complex Behaviour*, Springer Series in Synergetics **32**, Springer-Verlag, 256pp.
191. Mayer-Kress G, Yates F E, Benton L, Keidel M, Tirsch W, Poppl S J, and Geist K (1988) Dimensional analysis of nonlinear oscillations in brain, heart, and muscle, *Math. Biosci.* 90, 155-82.(4508)
192. Mayer-Kress G, and Layne S P (1987) Dimensionality of the human electroencephalogram, *Ann. N. Y. Acad. Sci.* 504, 62-87.(4519)
193. Mees A I (1991) Dynamical systems and tessellations detecting determinism in data, *Int. J. Bif. & Chaos* **1**, 777-94.
194. Mees A I, Rapp E P, and Jennings L S (1987) Singular value decomposition and embedding dimension, *Phys. Rev.* A36, 340-6.(4561)
195. Meyer T P, and Packard N H (1992) Local forecasting of high-dimensional chaotic dynamics, in Casdagli and Eubank (B1992), 249-63.
196. Mindlin G B, Solari H G, Natiello M A, Gilmore R, and Hou X-J (1991) Topological analysis of chaotic time series data from the Belousov-Zhabotinskii reaction, *J. Nonlin. Sci.* **1**, 147-73.

197. Mindlin G B, and Gilmore R (1992) Topological analysis and synthesis of chaotic time series, *Physica D*58, 229-42.
198. Möller M, Lange W, Mitschke F, and Abraham N B (1989) Errors from digitalizing and noise in estimating attractor dimensions, *Phys. Lett. A*138, 176-82.(4722)
199. Monastersky R (1990) Forecasting into chaos. Meteorologists seek to foresee unpredictability, *Science News* 137, 280-2.(4729)
200. Moon F C (1991) Experimental measurement of chaotic attractors in solid mechanics, *Chaos* (AIP) 1, 31-41.
201. Muldoon W R, Mackey R S, Huke J P, and Broomhead D S (1993) Topology from time series, *Physica D*65, 1-16.
202. Murao K, and Kohda T (1985) A new approach to time series analyses of chaotic orbits in one-dimensional maps, *Electron. Comm. Japan. Part I Comm.* 68, 2, 10-20.(4804)
203. Namajunas A, Pozela J, and Tamasevicius A (1988) An electronic technique for measuring phase space dimension from chaotic time series, *Phys. Lett.* 131A, 85-90.(4851)
204. Namajunas A, and Tamasevicius A (1992) A technique for measuring fractal dimension from time series on a real-time scale, *Physica D*58, 482-8.
205. Nese J-M (1989) Quantifying local predictability in phase space, *Physica D*35, 237-50.(4893)
206. Nicolaenko B, Foias C, and Temam R (B1989), eds., *The Connection Between Infinite Dimensional and Finite Dimensional Systems*, Contem. Math. 99, American Mathematical Society.
207. Nicolis C, and Nicolis G (1986) Reconstruction of the dynamics of the climatic system from time series data, *Proc. Nat. Acad. Sci. U.S.A.* 83, 536-40.(4933)
208. Nitsche G, and Dressler U (1992) Controlling chaotic dynamical systems using time delay coordinates, *Physica D*58, 153-64.
209. Noack B K, Ohle F, and Eckelman H (1992) Construction and analysis of differential equation from experimental time series of oscillatory systems, *Physica D*56, 389-405.
210. Noakes L, and Mees A I (1992) Dynamical signature, *Physica D*58, 243-50.
211. Nychka D, Ellner S, McCaffrey D, and Gallant A R (1992) Finding chaos in noisy systems, *J. Roy. Stat. Soc. B*54, 399-426.
212. Olsen L F (1987) Low dimensional strange attractors in epidemics of childhood diseases in Copenhagen, Denmark, in Degh, Holden, and Olsen (B1987), 249-54.(5022)
213. Osborne A R, and Provenzale A (1989) Finite correlation dimension for stochastic systems with power-law spectra, *Physica D*35, 357-81.(5058)
214. Ott E, Sauer T, and Yorke J A (1989) Lyapunov partition functions for the dimensions of chaotic sets, *Phys. Rev. A*39, 4212-22.(5075)
215. Ott E, Withers W D, and Yorke J A (1984) Is the dimension of chaotic attractors invariant under coordinate changes? *J. Stat. Phys.* 36, 687-97.(5076)
216. Packard N H (1990) A genetic learning algorithm for the analysis of complex data, *Complex Sys.* 4, 543-72.
217. Packard N H, Crutchfield J P, Farmer J D, and Shaw R S (1980) Geometry from a time series, *Phys. Rev. Lett.* 45, 712-6.(5091)
218. Palmer T (1989) A weather eye on unpredictability, *New Scient.* No. 1690, 56-9.(5110)
219. Palus M (1993) Testing for nonlinearity in the EEG, in Jansen and Brandt (B1993), 100-14.
220. Palus M, Albrecht V, and Dvorak I (1993) Information theoretic test for nonlinearity in time series, *Phys. Lett. A*175, 203-9.

221. Parlitz U (1992) Identification of true and spurious Lyapunov exponents from time series, *Int. J. Bif. & Chaos*, **2**, 155-65.
222. Pavlos G P, Karakatsanis L, Latoussakis J B, Dialetis D, and Papaioannou G (1994) Chaotic analysis of a time series composed of seismic events recorded in Japan, *Int. J. Bifur. & Chaos* **4**, 87-98.
223. Pawelzik P, and Schuster H G (1987) Generalized dimensions and entropies from a measured time series, *Phys. Rev. A* **35**, 481-4.(5147)
224. Pfister G, Buzug Th, and Enge N (1992) Characterization of experimental time series from Taylor-Couette flow, *Physica D* **58**, 441-54.
225. Pineda F J, and Sommerer J C (1994) Estimating generalized dimensions and choosing time delays, in Weigend and Gershenfeld (B1994), 367-85.
226. Pompe B, Kruschka J, and Leven B W (1986) State predictability and information flow in simple chaotic systems, *Z. Naturforsch.* **41a**, 801-18.(5323)
227. Press W H, and Rybicki G B (1992) Interpolation, realization, and reconstruction of noisy, irregularly sampled data, *Astrophys. J.* **398**, 169.
228. Press W H, and Rybicki G B (1994) Large-scale linear methods for interpolation, realization, and reconstruction of noisy, irregularly sampled data, in Weigend and Gershenfeld (B1994), 493-512.
229. Principe J C, Rathie A, and Kuo J-M (1992) Prediction of chaotic time series with neural networks and the issue of dynamic modeling, *Int. J. Bifur. & Chaos* **2**, 989-96.
230. Provenzale A, Osborne A R, and Soj R (1991) Convergence of the K_2 entropy for random noises with power-law spectra, *Physica D* **47**, 361-72.
231. Provenzale A, Smith L A, Vio R, and Murante G (1992) Distinguishing between low-dimensional dynamics and randomness in measured time series, *Physica D* **58**, 31-49.
232. Rabinovitch A, and Thieberger R (1987) Time series analysis of chaotic signals, *Physica D* **28**, 409-15.(5399)
233. Ramsey J B, and Yuan H-J (1990) The statistical properties of dimension calculation using small data sets, *Nonlinearity* **3**, 155-76.(5419)
234. Rapp P E, Albano A M, and Mees A I (1988) Calculation of correlation dimensions from experimental data: progress and problems, in Kelso, Mandell and Schlesinger (B1988), 191-205.(5432)
235. Read P L (1992) Applications of singular system analysis to baroclinic chaos, *Physica D* **58**, 455-68.
236. Rensing L, and Jaeger N I (B1985), eds., *Temporal Order*, Springer Series in Synergetics **29**, Springer-Verlag.
237. Rosenstein M J, Collins J J, and De Luca C J (1993) A practical method for calculating the largest Lyapunov exponent from small data sets, *Physica D* **65**, 117-34.
238. Rowlands G, and Sprott J C (1992) Extraction of dynamical equation from chaotic data, *Physica D* **58**, 251-9.
239. Rubin D M (1992) Use of forecasting signatures to help distinguish periodicity, randomness, and chaos in ripples and other spatial patterns, *Chaos (AIP)* **2**, 525-35.
240. Ruelle D (1990) Deterministic chaos: the science and the fiction, *Proc. R. Soc. London A* **427**, 241-8.(5669)
241. Sadovskii M A, and Pisarenko V F (1993) Prediction of time series, in Kravtsov (B1993), 161-72.
242. Sano M, and Sawada Y (1985) Measurement of the Lyapunov spectrum from a chaotic time series, *Phys. Rev. Lett.* **55**, 1082-5.(5719)

243. Saperstein A M (1988) The prediction of predictability, *Bull. of Atomic Scientists* 44, 40, October.(5723)
244. Sarkar S (B1986), ed., *Nonlinear Phenomena and Chaos*, Adam Hilger, xi + 336.
245. Sato S, Sano M, and Sawada Y (1987) Practical methods of measuring the generalized dimension and the largest Lyapunov exponent in high dimensional chaotic systems, *Prog. Theor. Phys. Lett.* 77, 1-5.(5749)
246. Sauer T (1992) A noise reduction method for signals from nonlinear system, *Physica D* 58, 193-201.
247. Sauer T (1994) Time series prediction using delay coordinate embedding, in Weigend and Gershenfeld (B1994), 175-93.
248. Sauer T, Yorke J A, and Casdagli M (1991) Embedology, *J. Stat. Phys.* 65, 579-616.
249. Savit R, and Green M (1991) Time series and dependent variables, *Physica D* 50, 95-116.
250. Scargle J (1990) Random and chaotic time series analysis: minimum phase-volume deconvolution, in Lam and Morris (B1990).(5756)
251. Schreiber T (1992) An extremely simple nonlinear noise-reduction algorithm, *Phys. Rev. E* 47, 2401-4.
252. Schreiber T, and Grassberger P (1991) A simple noise-reduction method for real data, *Phys. Lett. A* 160, 411-8.
253. Schwarz U, Benz A O, and Kurths J, and Witt A (1993) Analysis of solar spike events by means of symbolic dynamics methods, *Astron. Astrophys.* 277, 215-24.
254. Shen M, and Yang P-C (1990) Dimension and prediction of the sunspot, *Chinese J. Space Sci.* 10, 1-7 (in Chinese).(5909)
255. Shinbrot T, Ditto W, Grebogi C, Ott E, Spano M, and Yorke J A (1992) Using the sensitive dependence of chaos (the "butterfly effect") to direct trajectories in a experimental chaotic system, *Phys. Rev. Lett.* 68, 2863-6.
256. Skinner J E, Pratt C M, and Vybiral T (1993) Reduction in the correlation dimension of heartbeat intervals precedes imminent ventricular fibrillation in human subjects, *Am. Heart J.* 125, 731-43.
257. Smith L A (1988) Intrinsic limits on dimension calculations, *Phys. Lett.* 133A, 283-8.(6081)
258. Smith L A (1990) Quantifying chaos with predictive flows and maps: locating unstable periodic orbits, in Abraham, Albano, Passamante and Rapp (B1990).
259. Smith L A (1992) Identification and prediction of low dimensional dynamics, *Physica D* 58, 50-76.
260. Smith R L (1992) Optimal estimation of fractal dimension, in Casdagli and Eubank (B1992), 115-35.
261. Stoop R, and Meier P F (1987) Lyapunov exponents and dimensions determined from experimental time series, in Duong-Van (B1987), 582.(6189)
262. Stoop R, and Meier P F (1988) Evaluation of Lyapunov exponents and scaling functions from time series, *J. Opt. Soc. Am. B* 5, 1037-45.(6190)
263. Subba Rao T (1992) Analysis of nonlinear time series (and chaos) by bispectral methods, in Casdagli and Eubank (B1992), 199-226.
264. Sugihara G, and May R M (1990) Nonlinear forecasting as a way of distinguishing chaos from measurement error in time series, *Nature* 344, 734-41.(6209)
265. Takens F (1981) Detecting strange attractors in turbulence, *Lect. Notes in Math.* 898, 366-81.(6306)
266. Takens F (1984) Estimating the dimension of an attractor, *Lect. Notes in Math.* 1125, 99-106.

267. Termonia Y (1984) Kolmogorov entropy from a time series, *Phys. Rev. A* **29**, 1612.(6375)
268. Teubel A, and Rzazewski K (1989) Noise reduction in a Raman ring laser driven by a chaotic pump numerical approach, *J. Opt. Soc. Am. B* **6**, 550-3.(6381)
269. Theiler J (1987) Efficient algorithm for estimating the correlation dimension from a set of discrete points, *Phys. Rev. A* **36**, 4456-62.(6383)
270. Theiler J (1988) Lacunarity in a best estimator of fractal dimension, *Phys. Lett. A* **133**, 195-200.(6384)
271. Theiler J (1990) Estimating fractal dimension, *J. Opt. Soc. Am. A* **7**, 1055-73.
272. Theiler J (1991) Some comments on the correlation dimension of $1/f^\alpha$ noise, *Phys. Lett. A* **155**, 480-93.
273. Theiler J, Eubank S, Longtin A, Galdrikan B, and Farmer J (1992a) Testing for nonlinearity in time series: the method of surrogate data, *Physica D* **58**, 77-94.
274. Theiler J, Eubank S, Longtin A, Galdrikan B, and Farmer J (1992b) Using surrogate data to detect nonlinearity in time series, in Casdagli and Eubank (B1992), 163-88.
275. Thompson J M T (1984) Chaos and the unpredictability of computational and experimental simulations, in *Computational Methods and Experimental Measurements*, ed. Brebbia C A and Keramidas G A, Computational Mechanics Centre, Southampton, 11/35-11/52.(6396)
276. Thummel O (1987) Oscillations in the determination of Renyi dimension, *Ann. Phys.* **44**, 601-11.(6417)
277. Tong H (B1983) *Threshold Models in Nonlinear Time Series Analysis*, Springer-Verlag.
278. Tong H (B1990) *Nonlinear Time Series Analysis: A Dynamical Systems Approach*, Oxford University Press.
279. Tsonis A A, and Elsner J B (1992) Nonlinear prediction as a way of distinguishing chaos from random fractal sequences, *Nature*, **359**, 217-20.
280. Tuffillaro N B, Holzner R, Flepp L, Brun E, Finardi M, and Badii R (1991) Template analysis for a chaotic NMR laser, *Phys. Rev. A* **44**, R4786-8.
281. Tuffillaro N B, Solari H G, and Gilmore R (1990) Relative rotation rates: fingerprints for strange attractors, *Phys. Rev. A* **41**, 5717-20.(6508)
282. Turchetti G (B1989), ed., *Nonlinear Dynamics*, Proceedings of a Conference at Bologne, June 1988, World Scientific, xii + 424.
283. Vastano J A, and Kostelich E J (1986) Comparison of algorithms for determining Lyapunov exponents from experimental data, in Mayer-Kress (B1986), 100-7.(6621)
284. Vautard R, Yiou P, and Ghil M (1992) Singular-spectrum analysis: a toolkit for short, noisy chaotic signals, *Physica D* **58**, 95-126.
285. Vautard R, and Ghil M (1989) Singular spectrum analysis in nonlinear dynamics, with applications to paleoclimatic time series, *Physica D* **35**, 395-424.(6623)
286. Wales D J (1991) Calculating the rate loss of information from chaotic time series by forecasting, *Nature*, **350**, 485.
287. Weigend A S, and Gershenfeld N A (B1994), eds., *Time Series Prediction — Forecasting the Future and Understanding the Past*, Addison-Wesley, xvii + 643.
288. Wolf A, Swift J B, Swinney H L, and Vastano J A (1985) Determining Lyapunov exponents from a time series, *Physica D* **16**, 285-317.(6854)
289. Yang P-C, and Chen L-T (1990) On predictability of El Niño Southern oscillation, *Scientia Atmos. Sinica* **14**, 64-71 (in Chinese).(6951)
290. Zeng X, Eykholt R, and Pielke R A (1991) Estimating the Lyapunov-exponent spectrum from short time series of low precision, *Phys. Rev. Lett.* **66**, 3229-32.