References

Abrahart, R.J., Linda, S., & Pauline, E.K., (1999). Using pruning algorithms and genetic algorithms to optimise network architectures and forecasting inputs in a neural network rainfall-runoff model. *Journal of Hydroinformatics*, 1 (2), pp.103-114.

Aly, A.H., & Peralta, R.C., (1999). Optimal design of aquifer cleanup systems under uncertainty using a neural network and a genetic algorithm. *Water Resources Research*, 35 (8), pp.2523-2532.

Anderson, M.P., & Woessner, W.W., (1992). *Applied groundwater modelling - simulation of flow and advective transport*. New York: Academic Press.

ASCE Task Committee on Application of Artificial Neural Networks in Hydrology, Artificial neural networks in hydrology. I: Preliminary concepts. 2000a. *Journal of Hydrologic Engineering*, ASCE, 5 (2), pp.115-123.

ASCE Task Committee on Application of Artificial Neural Networks in Hydrology, Artificial neural networks in hydrology. II: Hydrologic applications. 2000b. *Journal of Hydrologic Engineering*, ASCE, 5 (2), pp.124-137.

Accurate Automation Corporation. 2002. Retrieved October 17, 2002 from http://www.accurate-automation.com/products/nnets.htm

Azzalini, A., (1996). *Statistical inference: based on the likelihood*, Chapman & Hall/CRC, Boca Raton ; New York.

Balkhair, K.S., (2002). Aquifer parameters determination for large diameter wells using neural network approach. *Journal of Hydrology*, 265 (1- 4), pp.118-128.

Basawa, I.V.; & Prakasa Rao, B.L.S., (1980). *Statistical inference for stochastic processes*. New York: Academic Press.

Batu, Vedat., (2006). *Applied Flow and Solute Transport Modelling in Aquifers*. Taylor & Francis Group, Boca Raton.

Bear. J., (1972). *Dynamics of fluids in porous media*. New York: American Elsevier Publishing Company.

Bear, J., (1979). *Hydraulics of Groundwater*. Israel: McGraw-Hill Inc.

Bear. J., Zaslavsky, D., & Irmay, S., (1968). *Physical principles of water percolation and seepage*. France : Unesco Press.

Beaudeau, P. , Leboulanger, T., Lacroix, M., Hanneton, S., & Wang, H.Q., (2001). Forecasting of turbid floods in a coastal, chalk karstic drain using an artificial neural network. *Ground Water*, 39 (1), pp.109-118.

Bebis, G., & Georgiopoulos, M., (1994). Feed-forward neural networks: Why network size is so important. *IEEE Potentials,* October/November, pp.27-31.

Bennett, A.F., (1992). *Inverse methods in Physical Oceanography*. New York: Cambridge University Press.

Bibby, B.M., & Sorensen, M., (1995). Bernoulli, 17.

Bibby, R., & Sunada, D.K., (1971). Statistical error analysis of a numerical model of confined groundwater flow, in stochastic hydraulics. In C.L. Chiu (Eds.). *Proceedings first international symposium on stochastic hydraulics*, pp.591-612.

Bishop, C.M., (1995). *Neural networks for pattern recognition*. Clarendon Press; Oxford University Press, New York.

Carrera, J., (1987). State of the art of the inverse problem applied to the flow and solute transport problems. *In Groundwater Flow and Quality Modelling*, NATO ASI Series, pp.549-585.

Carrera. J., (1988). State of the art of the inverse problem applied to the flow and solute transport equations. *In Groundwater Flow and Quality Modelling*, NATO ASI serial, volume 224, pp. 549-585. Norwell, Mass: Kulwer.

Carrera, J., & Glorioso, L., (1991). On geostatistical formulation of the groundwater inverse problem. *Advances in Water Resources*, 14 (5), pp.273-283.

Carrera, J., & Neuman, S.P., (1986a). Estimation of aquifer parameters under transient and steady state conditions, 1, Maximum likelihood method incorporating prior information. *Water Resources Research*, 22 (2), pp.199-210.

Carrera, J., & Neuman, S.P., (1986b). Estimation of aquifer parameters under transient and steady state conditions, 2, Uniqueness, stability and solution algorithms. *Water Resources Research*, 22 (2), pp.211-227.

Caruana, R.L., & Giles, S. L., (2001). Advances in neural information processing systems, 402.

Castellano, G., Fanelli, A.M., & Pelillo, M., (1997). An iterative pruning algorithm for feed-forward neural networks. *IEEE Transactions on Neural Networks*, 5, pp.961-970.

Chakilam, V.M., (1998). Forecasting the Future: Experimenting with Time Series data. Unpublished master's thesis, Birla Institute of Technology and Science, India. Retrieved September 8, 2001 from http://www.ucs.louisiana.edu/~vmc0583/Thesis_report%5B1%5D.rtf.pdf

Chandrasekhra, B.C., Rudrajah, N., & Nagaraj, S.T., (1980). Velocity and dispersion in porous media, *Int. J. Engng. Sci.*, 18, pp.921-929.

Chapman, B.M., (1979). Dispersion of soluble pollutions in nonuniform rivers, I, Theory. *Journal of Hydrology*, 40 (1/2), pp.139-152.

Cooley, R.L., (1977). A method of estimating parameters and assessing reliability for models of steady state groundwater flow, 1, Theory and numerical properties. *Water Resources Research*, 13 (2), pp.318-324.

Cooley, R.L., (1979). A method of estimating parameters and assessing reliability for models of steady state groundwater flow, 2, Application of statistical analysis. *Water Resources Research*, 15 (3), pp.603-617.

Cooley, R.L.,(1982). Incorporation of prior information on parameters into nonlinear regrassion groundwater flow models, 1, Theory. *Water Resources Research*, 18 (4), pp.965-976.

Cooley, R.L.,(1983). Incorporation of prior information on parameters into nonlinear regrassion groundwater flow models, 2, Applications. *Water Resources Research*, 19 (3), pp.662-676.

Coulibaly, P., Anctil, F. Aravena, R. & Bobee, B., (2001). Artificial neural network modeling of water table depth fluctuations. *Water Resources Research*, 37 (4), pp.885-896.

Cressie, N., (1993). *Geostatistics: A tool for environmental modelers*. In M.F. Goodchild, B. O. Parks, and L. T. Stegert (Eds) Environmenatal modelling with GIS. N.Y.: Oxford Press.

Cvetkovic, V., Shapiro, A., and Dagan, G., (1992). A solute flux approach to transport in heterogeneous formations 2. Uncertainty analysis. *Water Resources Research*, 28 (5), pp.1377-1388.

Cybenko, G., (1989). Approximation by superpositions of a sigmoidal function. *Mathematics of Control Signals and Systems*, 2, pp.203-314.

Dagan, G., (1984). Solute transport in heterogeneous porous formations. *Journal of fluid mechanics*, 145, pp.151-177.

Dagan, G., (1985). Stochastic modeling of groundwater flow by unconditional and conditional probabilities: the inverse problem. *Water Resources Research*, 21(1), pp.65-72.

Dagan, G., (1986). Statistical theory of groundwater flow and transport: pore to laboratory, laboratory to formation, and formation to regional scale. *Water Resources Research* , 22 (9), pp.120S-134S.

Dagan, G., (1988). Time dependent macrodispersion for solute transport in anisotropic heterogeneous aquifers. *Water Resources Research*, 24 (9), pp.1491-1500.

Dagan, G., & Rubin, Y., (1988). Stochastic identification of recharge, transmissivity, and storativity in aquifer transient flow: A quasi-steady approach. *Water Resources Research*, 24 (10), pp.1698-1710.

Dagan, G., Cvetkovic, V., & Shapiro, A., (1992). A solute flux approach to transport in heterogeneous formations 1. The general framework. *Water Resources Research*, 28 (5), pp.1369-1376.

Daley, R., (1991). *Atmospheric data analysis*. New York: Cambridge University Press.

Dietrich, C.R., & Newsam, G.N., (1989). A stability analysis of the geostatistical approach to aquifer transmissivity identification. *Stochastic Hydrology and Hydraulics*, 3(4), pp.293-316.

Farrell, B.F., (1999). Perturbation growth and structure in time-dependent flows. *Journal of the Atmospheric Sciences*, 56 (21), pp.3622-3639.

Farrell, B.F., (2002a). Perturbation growth and structure in uncertain flows. Part I. *Journal of the Atmospheric Sciences*, 59 (18), pp.2629-2646.

Farrell, B.F., (2002b). Perturbation growth and structure in uncertain flows. Part II. *Journal of the Atmospheric Sciences,* Boston, 59 (18), pp.2647-2664.

Fetter, C.W., (1999). *Contaminant hydrogeology*. New Jersey: Prentice-Hall.

Fetter, C.W., (2001). *Applied hydrogeology*. New Jersey: Prentice-Hall.

Flood, I., & Kartam, N., (1994). Neural network in civil engineering. I: Principles and understanding. *Journal of Computing in Civil Engineering*, 8 (2), pp.131-148.

Foussereau, X., Graham, W.D., Akpoji, G.A., Destouni, G., & Rao, P.S.C., (2001). Solute transport through a heterogeneous coupled vadose zone system with temporal random rainfall. *Water Resources Research*, 37 (6), pp.1577-1588.

Foussereau, X., Graham, W.D., & Rao, P.S.C., (2000). Stochastic analysis of transient flow in unsaturated heterogeneous soils. *Water Resources Research*, 36 (4), pp.891-910.

Freeze, R.A., (1972). *Regionalization of hydrologic parameters for use in mathematical models of groundwater flow*. In J.E. Gill (Eds), Hydrogeology, Gardenvale, Quebec: Harpell.

Freeze, R.A., (1975). A stochastic-conceptual analysis of one dimensional groundwater flow in a non-uniform homogeneous media. *Water Resources Research*, 11 (5), pp.725-741.

Freeze, R. A., & Cherry, J.A., (1979). *Groundwater*. Englewood Cliffs, NJ: Prentice Hall.

Freeze, R.A., & S.M., Gorelick, (2000). Convergence of stochastic optimization and decision analysis in the engineering design of aquifer remediation. *Ground Water*, 38 (3), pp.328-339.

Fried, J.J., (1972). Miscible pollution of ground water: A study of methodology. In A. K Biswas (Eds.). *Proceedings of the international symposium on modelling techniques in water resources systems*, vol 2, pp.362-371. Ottawa, Canada.

Fried, J.J., (1975). *Groundwater pollution*. Amsterdam: Elsevier Scientific Publishing Company.
Frind, E.O., & Pinder, S.F., (1973). Galerkin solution to the inverse problem for aquifer transmissivity. *Water Resources Research*, 9 (4), pp.1397-1410.
Gaines, J.G., & Lyons, T.J., (1997). Variable step size control in the numerical solution of stochastic differential equations. *SIAM Journal on Applied Mathematics*, 57, pp.1455-1484.
Gelhar, L.W., (1986). Stochastic subsurface hydrology from theory to applications. *Water Resources Research*, 22 (9), pp.135S-145S.
Gelhar, L.W., & Axness, C.L., (1983). Three dimensional stochastic of macro dispersion aquifers. *Water Resources Research*, 19 (1), pp.161-180.
Gelhar, L.W., Gutjahr,A.L., & Naff, R. L., (1979). Stochastic analysis of microdispersion in a stratified aquifer. *Water Resources Research*, 15 (6), pp.1387-1391.
Gelhar, L.W., (1986). Stochastic subsurface hydrology from theory to applications. *Water Resources Research*, 22, (9), pp.135S-145S.
Ghanem, R.G., & Spanos, P.D., (1991). *Stochastic finite elements: a spectral approach*. New York: Springer-Verlag.
Gill W.N., & Sankarasubramanian, R.,(1970). Exact analysis of unsteady convective diffusion. *Proc. Roy. Soc. Lond*. A. 316, pp.341-350.
Gillespie, D.T., (1992). *Markov Processes: An Introduction for Physical Scientists*. Academic Press, San Diego.
Ginn, T.R., & Cushman., J.H., (1990). Inverse methods for subsurface flow: A critical review of stochastic techniques. *Stochastic Hydrology and Hydraulics*, 4: pp.1-26.
Gomez-Hernandez, J.J., Sahuquillo, A., & Capilla, J.E.,(1997). Stochastic simulation of transmissivity fields conditional to both transmissivity and piezometric data, 1, *Theory. Journal of Hydrology*, 203, pp.162-174.
Grindord, P., & Impey, M.D., (1991). *Fractal field simulations of tracer migration within the WIPP Culebra Dolamite.* Intera Inf. Technology, UK.
Groundwater Foundation. 2001. Retrieved on 22 May 2001 from http://www.groundwater.org/Group, W.S. 2005. Frederick, MD.
Gutjahr, A.L., & Wilson, J.R., (1989). Co-kriging for stochastic flow models. *Transport in Porous Media*, 4 (6), pp.585-598.
Hall, A.R., (2005). *Generalized method of moments*. Oxford University Press, Oxford; New York.
Harleman, D.R.F., & Rumer, R.R., (1963). The analytical solution for injection of a tracer slug in a plane. *Fluid Mechanics*, 16.
Harter, T., & Yeh, T.C.J., (1996). Stochastic analysis of solute transport in heterogeneous, variably saturated soils. *Water Resources Research*, 32 (6), pp.1585-1596.
Hassan, A.E., & Hamed, K.H., (2001). Prediction of plume migration in heterogeneous media using artificial neural networks. *Water Resources Research*, 37 (3), pp.605-625.
Hassoun, M.H., (1995). *Fundamentals of artificial neural networks*. Cambridge: MIT Press.
Haykin, S., (1994). *Neural networks : a comprehensive foundation*. New York: McMillan.
Hecht-Nielsen, R., (1987). Kolmogorov's mapping neural network existence theorem. *In 1st IEEE International Joint Conference on Neural Networks.* Institute of Electrical and Electronic Engineering, San Diego, 21-24 June 1987. San Diego, pp.11-14.

Hegazy, T., Fazio, P., & Moselhi, O., (1994). Developing practical neural network applications using back-propagation. *Microcomputers in Civil Engineering*, 9, pp.145-459.

Herlet, I., (1998). Ground Water Contamination in the Heathcote / Woolston area, Christchurch, New Zealand. Unpublished master thesis, Canterbury University, New Zealand.

Hernandez, D.B., (1995). *Lectures on Probability and Second Order Random Fields*, World Scientific, Singapore.

Hertz, J.A., Krogh, A., & Palmer, R.G., (1991). *Introduction to the theory of neural computation. Redwood City*, California: Addison-Wesley Publishing.

Hoeksema, R., & Kitanidis, P.K., (1984). An application of the geostatistical approach to the inverse problem in two-dimensional groundwater modeling. *Water Resources Research*, 20 (7): pp.1003-1020.

Holden, H., Øksendal, B., Uboe,J., & Zhang, T., (1996). *Stochastic partial differential equations*, Birkhauser, Boston.

Hong, Y-S. , & Rosen, M.R., (2001). Intelligent characterisation and diagnosis of the groundwater quality in an urban fractured-rock aquifer using an artificial neural network. *Urban Water*, 3 (3), pp.193-204.

Huang, K., Van Genuchten, M.T., & Zhang, R., (1996a). Exact solution for one-dimensional transport with asymptotic scale dependent dispersion. *Applied Mathematical Modelling*, 20 (4), pp.298-308.

Huang, K., Toride, N., & Van Genuchten, M.T., (1996b). Experimental investigation of solute transport in large, homogeneous heterogeneous, saturated soil columns. *International Journal of Rock Mechanics and Mining Sciences*, 33 (6), 249A.

Islam, S., & Kothari, R., (2000). Artificial neural networks in remote sensing of hydrologic processes. *Journal of Hydrologic Engineering*, 5 (2), pp.138-144.

Jazwinski, A.H., (1970). *Stochastic processes and filtering theory*. New York: Academic Press.

Johnson, V.M., & Rogers, L.L., (2000). Accuracy of neural network approximators in simulation-optimization. *Journal of Water Resources Planning and Management*, 126 (2), pp.48-56.

Kaski, S., Kangas, J., & Kohonen, T., (1998). Bibliography of Self-Organizing Map (SOM) Papers: 1981-1997. *Neural Computing Surveys*, 1, pp.102-350.

Keidser, A., & Rosbjerg, D.,(1991). A comparison of four inverse approaches to groundwater flow and transport parameter identification. *Water Resources Research*, 27 (9), pp.2219-2232.

Keizer, J., (1987). *Statistical thermodynamics of nonequilibrium processes*. Springer-Verlag, New York.

Kerns, W.R., (1977). Public policy on ground water protection, in *Proceedings of a National Conference*, Virginia Polytechnic Institute and State University, 13-16 April 1977. Blacksburg, Virginia: USA.

Kitanidis, P., & Vomvoris, E.G., (1983). A geostatistical approach to the problem of groundwater modelling (steady state) and one-dimensional simulation. *Water Resources Research*, 19 (3), pp.677-690.

Kitanidis, P.K., (1985). Prior information in the geostatistical approach. In C. T. Harry (Eds) *proceedings of the special conference on Computer Application in Water Resources*, Buffalo, N.J., June 10-12, 1985. N.J: ASCE.

Kitanidis, P.K., (1997). *Introduction to Geostatistics – application in hydrogeology*. Cambridge : University press.

Klebaner, F.C., (1998). *Introduction to stochastic calculus with applications*. Springer-Verlag, New York.

Kleinecke, D.S., (1971). Use of linear programming for estimating geohydrologic parameters of groundwater basins. *Water Resources Research*, 7 (2), pp.367-375.

Klenk, I.D., & Grathwohl, P., (2002). Transverse vertical dispersion in groundwater and the capillary fringe. *Journal of Contaminant Hydrology*, 58 (1-2), pp. 111-128.

Klotz, D., Seiler, K.-P., Moser, H., & Neumaier, F., (1980). Dispersivity and velocity relationship from laboratory and field experiments. *Journal of Hydrology*, 45 (1/2), pp.169-184.

Kloeden, P.E., Platen, E., & Schurz, Z., (1997). *Numerical solution of SDE through computer experiments*. Springer, Berlin; New York.

Kohonen, T., (1982). Self-organized formation of topologically correct feature maps. *Biological Cybernetics*, 43, pp. 59-69.

Kohonen, T., (1990). The Self-Organizing Map. In Proceeding of the IEEE, 78(9), pp.1464-1480.

Koutsoyiannis, D., (1999). Optimal decomposition of covariance matrices for multivariate stochastic models in hydrology. *Water Resources Research*, 35 (4), pp.1219-1229.

Koutsoyiannis, D., (2000). A generalized mathematical framework for stochastic simulation and forecast of hydrologic time series. *Water Resources Research*, 36 (6), pp.1519-1533.

Kruseman, G.P. , & De. Ridder, N.A., (1970). *Analysis and evaluation of pumping test data*. International Institute Land Reclamation Improvement Bulletin, 200(11).

Kubrusly, C.S., (1977). Distributed parameter system identification a survey. *International journal of control*, 26 (4), pp.509-535.

Kuiper, L.K., (1986). A comparison of several methods for the solution of the inverse problem in two-dimensional steady state groundwater flow modelling. *Water Resources Research*, 22 (5), pp.705-714.

Kulasiri, D., (1997). *Computational modelling of solute transport using stochastic partial differential equations – A report to Lincoln Environment Ltd*. Centre for Computing and Biometrics, Lincoln University, New Zealand.

Kulasiri, D., & Richards, S., (2008). Investigation of a stochastic model for multiscale dispersion in porous media. *Journal of Porous Media*. *11*(6), pp.507-524.

Kulasiri, D., & Verwoerd, W., (2002). *Stochastic Dynamics: Modeling Solute Transport in Porous Media*, North-Holland Series in Applied Mathematics and Mechanics, vol 44. Amsterdam: Elsevier Science Ltd.

Kulasiri, D., & Verwoerd, W., (1999). A stochastic model for solute transport in porous media: mathematical basis and computational solution, *Proc. MODSIM 1999 Inter. Congress on Modelling and Simulation*, 1, pp.31-36.

Kutoyants, Yu. A., (1984). *Parameter estimation for stochastic processes*. Berlin : Herderman Verlag.

Lee, D.R., Cherry, J.A., & Pickens, J.F., (1980). Groundwater transport of a salt tracer through a sandy lakebed. *Limonology and Oceanograpgy*, 25 (1), 45-61.

Leeuwen, M.V., Butler, A.P., Te Stroet, B.M., & Tompkins, J.A., (2000). Stochastic determination of well capture zones conditioned on regular grids of transmissivity. *Water Resources Research*, 36 (4), pp.949-958.

Lipster, R.S., & Shirayev, A.N., (1977). *Statistics of random processes: Part I. General theory*. N.Y.: Springer.

Lindsay, J. B., Shang, J.Q., & Rowe, R.K., (2002). Using Complex Permittivity and Artificial Neural Networks for Contaminant Prediction. *Journal of Environmental Engineering*, 128 (8), pp.740-747.

Lischeid, G., (2001). Investigating short-term dynamics and long-term trends of SO4 in the runoff of a forested catchment using artificial neural networks. *Journal of Hydrology*, 243 (1-2), pp.31-42.

Loll, P., & Moldrup, P., (2000). Stochastic analysis of field-scale pesticide leaching risk as influenced by spatial variability in physical and biochemical parameters. *Water Resources Research*, 36 (4), pp.959-970.

Lorenc, A.C., (1986). Analysis methods for numerical weather prediction. *Quarterly journal of the Royal Meteorological Society*, 112, pp.1177-1194.

Maier, H.R., & Dandy, G.C., (1998). The effect of internal parameters and geometry on the performance of back-propagation neural networks: an empirical study. *Environmental Modelling & Software*, 13, pp.193-209.

Maier, H.R., & Dandy, G.C., (2000). Neural networks for the prediction and forecasting of water resources variables: a review of modelling issues and applications. *Environmental Modelling & Software*, 15, pp.101-124.

Maren, A., C Harston,., & Pap, R., (1990). *Handbook of neural computing applications*. California: Academic Press.

McLaughlin, D., (1975). *Investigation of alternative procedures for estimating ground-water basin parameters*, Water Resources Engineering. California: Walnut Creek.

McLaughlin, D., & Townley, L.R., (1996). A reassessment of the groundwater inverse problem. *Water Resources Research*, 32 (5), pp.1311-1161.

McMillan, W.D., (1966). *Theoretical analysis of groundwater basin operations.* Water Resour. Center Contrib., 114: University of California, Berkerly, 167.

Merritt, W.F., Pickens, J.F., & Allison,G.B., (1979). Study of transport in unsaturated sands using radioactive tracers. In P. J. Barry (Eds.). *Second report on Hydrological and geo-chemical studies in the Perch Lake Basin*, pp. 155-164.

Minns, A.W., & Hall, M.J., (1996). Artificial neural networks as rainfall-runoff models. *Hydrological Sciences Journal*, 41 (3), pp.399-417.

Miralles-Wilhelm, F., & Gelhar, L.W., (1996). Stochastic analysis of sorption macrokinetics in heterogeneous aquifers. *Water Resources Research*, 32 (6), pp. 1541-1550.

Morshed, J., & Kaluarachchi, J.J., (1998). Application of artificial neural network and generic algorithm in flow and transport simulations. *Advances in Water Resources*, 22 (2),pp.145-158.

Morton, K.W., & D.F. Mayers., (1994). *Numerical Solution of Partial Differential Equations*. Cambridge: Cambridge University Press.

Mukhopadhyay, A., (1999). Spatial estimation of transmissivity using artificial neural network. *Ground Water*, 37 (3), pp.458-464.

Nielsen, J.N., Madsen, H., & Young, P.C., (2000). Annual Reviews in Control **24**, 83.

Neuman, S.P., Winter, C.L., & Neuman, C.N., (1987). Stochastic theory of field scale Fickian dispersion in anisotropic porous media. *Water Resources Research*, 23 (3), pp.453-466.
Neuman, S.P., (1973). Calibration of distributed parameter groundwater flow models viewed as a multiple-objective decision process under uncertainty. *Water Resources Research*, 9 (4), pp.1006-1021.
Neural Ware., (1998). *Neural Computing: A Technology Handbook for NeuralWorks Professional II/PLUS and NeuralWorks Explorer* (324 pp). USA: Aspen Technology Inc.
Oakes, D.B., & Edworthy, D.J., (1977). Field measurements of dispersion coefficients in the United Kingdom. In groundwater quality, measurement, prediction and protection, *Water Research Centre*, England, pp.327-340.
Ogata, A., (1970). Theory of dispersion in granular medium. *U. S. Geological survey professional paper*, No.411-I.
Ogata, A., & Bank, R.B., (1961). A solution of the differential equation of longitudinal dispersion in porous media. *USGS, Professional paper*, No. 411-A.
Øksendal, B., (1998). *Stochastic Differential Equations*. Berlin: Springer Verlag.
Ottinger, H.C., (1996). *Stochastic processes in polymeric fluids: tools and examples for developing simulation algorithms*. Springer, Berlin; New York.
Painter, S., (1996). Stochastic interpolation of aquifer properties using fractional Levy motion. *Water Resources Research*, 32 (5), pp.1323-1332.
Painter, S., & Cvetkovic, V., (2001). Stochastic analysis of early tracer arrival in a segmented fracture pathway. *Water Resources Research*, 37 (6), pp. 1669-1680.
Peaudecef, P., & Sauty, J.P., (1978). Application of a mathematical model to the characterization of dispersion effects of groundwater quality. *Progress of Water Technology,* 10 (5/6), pp.443-454.
Pickens, J.F., & Grisak, G.E., (1981). Scale-dependent dispersion in a stratified granular aquifer. *Water Resources Research*, 17 (4), pp.1191-1211.
Polis, M.P., (1982). The distributed system parameter identification problem: A survey of recent results. *In 3rd Symposium of Control of Distributed Systems*, Toulouse: France, pp.45-58.
Press, W.H., Teukolsky, S.A., Vetterling, W.T., & Flannery, B.P., (1992). *Numerical recipes in C, The art of scientific computing - second edition*. Cambridge: University Press.
RamaRao, B.S, LaVenue, A.M., De Marsily, G., & Marietta, M.G., (1995). Pilot point methodology for automated calibration of an ensemble of conditionally simulated transmissivity fields, 1, Theory and computational experiments. *Water Resources Research*, 31(3), pp.475-493.
Ranjithan, S., Eheart, J.W., & Garrett Jr, J.H., (1993). Neural network-based screening for groundwater reclamation under uncertainty. *Water Resources Research*, 29 (3), pp.563-574.
Rashidi, M., Peurrung, L., Thompson, A.F.B., & Kulp, T.J., (1996). Experimental analysis of pore-scale flow and transport in porous media. *Advances in Water Resources*, 19 (3), pp.163 - 180.
Rogers, L.L., & Dowla, F.U., (1994). Optimization of groundwater remdiation using artificial neural networks with parallel solute transport modeling. *Water Resources Research*, 30 (2), pp.457-481.

Rogers, L.L., Dowla, F.U., & Johnson, V.M., (1995). Optimal field-scale groundwater remediation using neural networks and the genetic algorithm. *Environmental Science and Technology*, 29 (5), pp.1145-1155.

Rojas, R., (1996). *Neural Networks: A Systematic Introduction*. Berlin: Springer-Verlag.

Rajanayaka, C., & Kulasiri, D., (2001). Investigation of a parameter estimation method for contaminant transport in aquifers. *Journal of Hydroinformatics*, 3(4), pp.203-213.

Rumelhart, D.E., McClelland, J.L., & University of California San Diego PDP Research Group, (1986). *Parallel distributed processing : explorations in the microstructure of cognition* . MIT Press, Cambridge, Mass..

Ronald Gallant, A, & Tauchen, G., (1999). *Journal of Econometrics,* 92, pp.149.

Rashidi, M., Peurrung, L., Thompson, A.F.B., & Kulp, T.L., (1996). Experimental analysis of pore-scale flow and transport in porous media. *Adv. Water Resour*., 19, pp.163-180.

Ripley, B.D., (1996). *Pattern recognition and neural networks*. Cambridge University Press, Cambridge ; New York.

Rubin, Y., & Dagan, G., (1992). A note on head and velocity covariances in three-dimensioanl flow through heterogeneous anisotropic porous media. *Water Resources Research*, 28 (5), pp.1463-1470.

Rudnitskaya, A., Ehlert, A., Legin, A., Vlasov, Y., & Büttgenbach, S., (2001). Multisensor system on the basis of an array of non-specific chemical sensors and artificial neural networks for determination of inorganic pollutants in a model groundwater. *Talanta*, 55 (2), pp.425-431.

Rudraiah, N., Siddheshwar, P.G., Pal, D., & Vortmeyer, D., (1988). Non-Darcian Effects on Transient Dispersion in Porous Media. *Proc. ASME Int. Symp*. HTD 96, pp.623-628.

Rumelhart, D.E., McClelland, J.L., & PDP Research Group. (1986). *Parallel distributed processing: Explorations in the microstructure of cognition.* Vol. 1. Cambridge: MIT Press.

Sagar, B., & Kisiel, C.C., (1972). Limits of deterministic predictability of saturated flow equations. In Proceedings of the second symposium on fundamentals of transport phenomena in porous media, vol 1, *international association of hydraulic research*, 1972. Guelph: Canada, pp.194-205.

Samarasinghe, S., (2006). *Neural Networks for Applied Sciences and Engineering: From fundamentals to Complex Pattern Recognition*. Taylor and Franscis Group, USA.

Sarle, W.S., (1994). Neural networks and statistical models. *In Proc. 19th Annual SAS Users Group International Conference*, April 1994, pp. 1538-1550.

Sarma, P.B.S., ; & Immaraj, A.,(1990). Estimation of aquifer parameters through identification problem. *Hydrology Journal*, 113 (1).

Scarlatos, P.D. (2001). Computer modeling of fecal coliform contamination of an urban estuarine system. *Water Science and Technology: a Journal of the International Association on Water Pollution Research*, 44 (7), pp.9-16.

Scheibe, T., & Yabusaki, S., (1998). Scaling of flow and transport behavior in heterogeneous groundwater systems. *Advances in Water Resources*, 22 (3), pp.223-238.

Spitz, K., & Moreno, J., (1996). *A practical guide to groundwater and solute transport modelling.* New Jersey: Wiley-Interscienc.

Sudicky, E.A., & Cherry, J.A., (1979). Field observations of tracer dispersion under natural flow conditions in an unconfined sandy aquifer. *Water Quality Research Journal of Canada*, 14, pp.1-17.

Sun, N.Z., (1994). *Inverse Problems in Groundwater Modelling*. London: Kluwer Academic Publishers.

Sun, N.Z., & Yeh, W.W.G., (1992). A stochastic inverse solution for transient groundwater flow: Parameter identification and reliability analysis. *Water Resources Research*, 28 (12), pp.3269-3280.

Taylor, G., (1953). Dispersion of soluble matter in solvent flowing through a tube. *Proc. Roy. Soc. Lond*, A. 219, pp.186-203.

Theis, C.V., (1962). *Notes on dispersion I fluid flow by geologic features*. In J. M Morgan, D. K Kamison and J. D. Stevenson (Eds.). Proceedings of conference on ground disposal of radioactive wastes. Chalk River, Ont., Canada.

Theis, C.V., (1963). Hydrologic phenomena affecting the use of tracers in timing ground water flow. *Radioisotopes in Hydrology*, pp.193-206.

Thompson, A.F.B., & Gray, W.G., (1986). A second-order approach for the modelling of dispersive transport in porous media, 1. Theoretical development. *Water Resource Res.*, 22(5), pp. 591-600.

Timmer, J., (2001). *Chaos*. Solitons & Fractals 11, 2571.

Timothy, W.E.H., Krumbein, W.C., Irma, W., & Beckman, W.A. (Jr)., (1965). *A surface fitting program for areally distributed data from the earth sciences and remote sensing*. Contractor report. NASA.

Towell, G.G., Craven, M.K., & Shavlik, J.W., (1991). Constructive induction in knowledge-based neural networks. *In proceedings of the 8th International Workshop on Machine Learning*, Morgan Kaufman, San Mateo, pp.213-217.

Triola, M.F., (2004). *Elementary statistics*. Pearson/Addison-Wesley, Boston.

Unny. T.E., (1989). Stochastic Partial Differential Equations in Ground Water Hydrology – Part 1. *Journal Hydrology and Hydraulics*; 3, pp.135-153.

Unny, T.E., (1985). Stochastic partial differential equations in groundwater hydrology. Part 1. Stochastic Hydrol. *Hydraul*., 3, pp.135 – 153.

Vanderborght, J., & Vereecken, H., (2002). Estimation of local scale dispersion from local breakthrough curves during a tracer test in a heterogeneous aquifer: the Lagrangian approach. *Journal of Contaminant Hydrology*, 54 (1-2), pp.141-171.

Walton, W.C., (1979). Progress in analytical groundwater modelling. *Journal of hydrology*, 43, pp.149-159.

Wang, H.F., & Anderson, M.P., (1982). *Introduction to groundwater modelling*. USA: W.H. Freeman.

Warren, J.E., & Price, H.S., (1961). Flow in heterogeneous porous media. *Society of Petrol Engineering Journal*, 1, pp.153-169.

Watts, D.G., (1994). *The Canadian Journal of Chemical Engineering* **72**, 701.

Welty, C., & Gelhar, L.W. ,(1992). Simulation of large-scale transport of variable density and viscosity fluids using a stochastic mean model. *Water Resources Research*, 28 (3), pp.815-827.

Yang, J., Zhang , R., Wu, J., & Allen, M.B., (1996). Stochastic analysis of adsorbing solute transport in two dimensional unsaturated soils. *Water Resources Research*, 32 (9), pp.2747-2756.

Yeh, W.W-G., (1986). Review of parameter identification procedures in groundwater hydrology: The inverse problem. *Water Resources Research*, 22 (2), pp.95-108.

Young. N., (1988). *An introduction to Hilbert space*. Cambridge: Cambridge University Press.

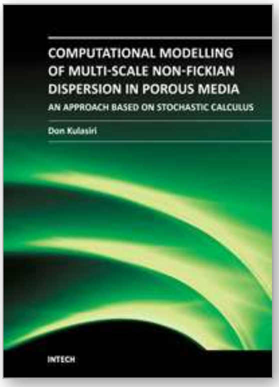
Zhang, D., & Sun, A.Y., (2000). Stochastic analysis of transient saturated flow through heterogeneous fractured porous media: A double-permeability approach. *Water Resources Research,* 36 (4), pp.865-874.

Zheng, C., & Bennett, G.D., (1995). *Applied contaminant transport modelling*. New York: Van Nostrand Reinhold.

Zhu, A.X., (2000). Mapping soil landscape as spatial continua: The neural network approach. *Water Resources Research*, 36 (3), pp.663-677.

Zimmerman, D.A., Marsily, G. de., Gotway, C.A., Marietta, M.G., Axness, C.L., & Beauheim, R.L., (1998). A comparison of seven geostatistical based inverse approaches to estimate transmissivities for modelling advective transport by groundwater flow. *Water Resources Research*, 34 (6), pp.1373-1413.

Index



Computational Modelling of Multi-scale Solute Dispersion in Porous Media - An Approach Based on Stochastic Calculus
Edited by

ISBN 978-953-307-726-0
Hard cover, 234 pages
Publisher InTech
Published online 04, November, 2011
Published in print edition November, 2011

This research monograph presents a mathematical approach based on stochastic calculus which tackles the "cutting edge" in porous media science and engineering - prediction of dispersivity from covariance of hydraulic conductivity (velocity). The problem is of extreme importance for tracer analysis, for enhanced recovery by injection of miscible gases, etc. This book explains a generalised mathematical model and effective numerical methods that may highly impact the stochastic porous media hydrodynamics. The book starts with a general overview of the problem of scale dependence of the dispersion coefficient in porous media. Then a review of pertinent topics of stochastic calculus that would be useful in the modeling in the subsequent chapters is succinctly presented. The development of a generalised stochastic solute transport model for any given velocity covariance without resorting to Fickian assumptions from laboratory scale to field scale is discussed in detail. The mathematical approaches presented here may be useful for many other problems related to chemical dispersion in porous media.