

STUDIES IN *FUZZINESS*  
AND *SOFT COMPUTING*

Patrick Wong · Fred Aminzadeh  
Masoud Nikravesh  
Editors

# **Soft Computing for Reservoir Characterization and Modeling**



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# Soft Computing For Reservoir Characterization And Modeling

**Fred Aminzadeh, Paul De Groot**



## **Soft Computing For Reservoir Characterization And Modeling:**

*Soft Computing for Reservoir Characterization and Modeling* Patrick Wong, Fred Aminzadeh, Masoud Nikravesh, 2013-11-11 In the middle of the 20th century Genrich Altshuller a Russian engineer analysed hundreds of thousands of patents and scientific publications From this analysis he developed TRIZ G Altshuller 40 Principles TRIZ Keys to Technical Innovation TRIZ Tools Volume 1 First Edition Technical Innovation Center Inc Worcester MA January 1998 Y Salamatov TRIZ The Right Solution at the Right Time A Guide to Innovative Problem Solving Insytex B V 1999 the theory of inventive problem solving together with a series of practical tools for helping engineers solving technical problems Among these tools and theories the substance field theory gives a structured way of representing problems the patterns of evolution show the lifecycle of technical systems the contradiction matrix tells you how to resolve technical contradictions using the forty principles that describe common ways of improving technical systems For example if you want to increase the strength of a device without adding too much extra weight to it the contradiction matrix tells you that you can use Principle 1 Segmentation or Principle 8 Counterweight or Principle 15 Dynamicity or Principle 40 Composite Materials I really like two particular ones Principle 1 Segmentation and Principle 15 Dynamicity Segmentation shows how systems evolve from an initial monolithic form into a set of independent parts then eventually increasing the number of parts until each part becomes small enough that it cannot be identified anymore

### **Soft Computing-based Modeling for Intelligent Reservoir Characterization and Geosciences Applications** Masoud Nikravesh, 2004

*Soft Computing and Intelligent Data Analysis in Oil Exploration* M. Nikravesh, L.A. Zadeh, Fred Aminzadeh, 2003-04-22 This comprehensive book highlights soft computing and geostatistics applications in hydrocarbon exploration and production combining practical and theoretical aspects It spans a wide spectrum of applications in the oil industry crossing many discipline boundaries such as geophysics geology petrophysics and reservoir engineering It is complemented by several tutorial chapters on fuzzy logic neural networks and genetic algorithms and geostatistics to introduce these concepts to the uninitiated The application areas include prediction of reservoir properties porosity sand thickness lithology fluid seismic processing seismic and bio stratigraphy time lapse seismic and core analysis There is a good balance between introducing soft computing and geostatistics methodologies that are not routinely used in the petroleum industry and various applications areas The book can be used by many practitioners such as processing geophysicists seismic interpreters geologists reservoir engineers petrophysicist geostatisticians asset managers and technology application professionals It will also be of interest to academics to assess the importance of and contribute to R D efforts in relevant areas

**Reservoir Characterization** Fred Aminzadeh, 2022-01-06 RESERVOIR CHARACTERIZATION The second volume in the series Sustainable Energy Engineering written by some of the foremost authorities in the world on reservoir engineering this groundbreaking new volume presents the most comprehensive and updated new processes equipment and practical applications in the field Long thought of as not

being sustainable newly discovered sources of petroleum and newly developed methods for petroleum extraction have made it clear that not only can the petroleum industry march toward sustainability but it can be made greener and more environmentally friendly Sustainable energy engineering is where the technical economic and environmental aspects of energy production intersect and affect each other This collection of papers covers the strategic and economic implications of methods used to characterize petroleum reservoirs Born out of the journal by the same name formerly published by Scrivener Publishing most of the articles in this volume have been updated and there are some new additions as well to keep the engineer abreast of any updates and new methods in the industry Truly a snapshot of the state of the art this groundbreaking volume is a must have for any petroleum engineer working in the field environmental engineers petroleum engineering students and any other engineer or scientist working with reservoirs This outstanding new volume Is a collection of papers on reservoir characterization written by world renowned engineers and scientists and presents them here in one volume Contains in depth coverage of not just the fundamentals of reservoir characterization but the anomalies and challenges set in application based real world situations Covers reservoir characterization for the engineer to be able to solve daily problems on the job whether in the field or in the office Deconstructs myths that are prevalent and deeply rooted in the industry and reconstructs logical solutions Is a valuable resource for the veteran engineer new hire or petroleum engineering student

*Evolving Rule-Based Models* Plamen P. Angelov, 2013-03-20 The idea about this book has evolved during the process of its preparation as some of the results have been achieved in parallel with its writing One reason for this is that in this area of research results are very quickly updated Another is possibly that a strong unchallenged theoretical basis in this field still does not fully exist From other hand the rate of innovation competition and demand from different branches of industry from biotech industry to civil and building engineering from market forecasting to civil aviation from robotics to emerging e commerce is increasingly pressing for more customised solutions based on learning consumers behaviour A highly interdisciplinary and rapidly innovating field is forming which focus is the design of intelligent self adapting systems and machines It is on the crossroads of control theory artificial and computational intelligence different engineering disciplines borrowing heavily from the biology and life sciences It is often called intelligent control soft computing or intelligent technology Some other branches have appeared recently like intelligent agents which migrated from robotics to different engineering fields data fusion knowledge extraction etc which are inherently related to this field The core is the attempts to enhance the abilities of the classical control theory in order to have more adequate flexible and adaptive models and control algorithms

**Fuzzy Partial Differential Equations and Relational Equations** Masoud Nikraves, Lofti A. Zadeh, Victor Korotkikh, 2014-03-12 During last decade significant progress has been made in the oil industry by using soft computing technology Underlying this evolving technology there have been ideas transforming the very language we use to describe problems with imprecision uncertainty and partial truth These developments offer exciting opportunities but at the same

time it is becoming clearer that further advancements are confronted by fundamental problems. The whole idea of how human process information lies at the core of the challenge. There are already new ways of thinking about the problems within theory of perception based information. This theory aims to understand and harness the laws of human perceptions to dramatically improve the processing of information. A matured theory of perception based information is likely to be properly positioned to contribute to the solution of the problems and provide all the ingredients for a revolution in science, technology, and business. In this context, Berkeley Initiative in Soft Computing (BISC), University of California Berkeley, from one side and Chevron Texaco from another, formed a Technical Committee to organize a Meeting entitled State of the Art Assessment and New Directions for Research to understand the significance of the field's accomplishments, new developments, and future directions. The Technical Committee selected and invited 15 scientists and industry experts as technical committee members from the related disciplines to participate in the Meeting, which took place at the University of California Berkeley and March 15-17, 2002.

**Towards Efficient Fuzzy Information Processing** Chongfu Huang, Yong Shi, 2012-11-03. When we learn from books or daily experience, we make associations and draw inferences on the basis of information that is insufficient for understanding. One example of insufficient information may be a small sample derived from observing experiments. With this perspective, the need for developing a better understanding of the behavior of a small sample presents a problem that is far beyond purely academic importance. During the past 15 years, considerable progress has been achieved in the study of this issue in China. One distinguished result is the principle of information diffusion. According to this principle, it is possible to partly fill gaps caused by incomplete information by changing crisp observations into fuzzy sets so that one can improve the recognition of relationships between input and output. The principle of information diffusion has been proven successful for the estimation of a probability density function. Many successful applications reflect the advantages of this new approach. It also supports an argument that fuzzy set theory can be used not only in soft science where some subjective adjustment is necessary but also in hard science where all data are recorded.

**Enhance Oil and Gas Exploration with Data-Driven Geophysical and Petrophysical Models** Keith R. Holdaway, Duncan H. B. Irving, 2017-10-04. Leverage Big Data analytics methodologies to add value to geophysical and petrophysical exploration data. Enhance Oil Gas Exploration with Data-Driven Geophysical and Petrophysical Models demonstrates a new approach to geophysics and petrophysics data analysis using the latest methods drawn from Big Data. Written by two geophysicists with a combined 30 years in the industry, this book shows you how to leverage continually maturing computational intelligence to gain deeper insight from specific exploration data. Case studies illustrate the value propositions of this alternative analytical workflow, and in-depth discussion addresses the many Big Data issues in geophysics and petrophysics. From data collection and context through real-world everyday applications, this book provides an essential resource for anyone involved in oil and gas exploration. Recent and continual advances in machine learning are driving a rapid increase in empirical modeling capabilities. This book shows you

how these new tools and methodologies can enhance geophysical and petrophysical data analysis increasing the value of your exploration data Apply data driven modeling concepts in a geophysical and petrophysical context Learn how to get more information out of models and simulations Add value to everyday tasks with the appropriate Big Data application Adjust methodology to suit diverse geophysical and petrophysical contexts Data driven modeling focuses on analyzing the total data within a system with the goal of uncovering connections between input and output without definitive knowledge of the system's physical behavior This multi faceted approach pushes the boundaries of conventional modeling and brings diverse fields of study together to apply new information and technology in new and more valuable ways Enhance Oil Gas Exploration with Data Driven Geophysical and Petrophysical Models takes you beyond traditional deterministic interpretation to the future of exploration data analysis

*Artificial Intelligence and Data Analytics for Energy Exploration and Production* Fred Aminzadeh,Cenk Temizel,Yasin Hajizadeh,2022-08-26 ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS FOR ENERGY EXPLORATION AND PRODUCTION This groundbreaking new book is written by some of the foremost authorities on the application of data science and artificial intelligence techniques in exploration and production in the energy industry covering the most comprehensive and updated new processes concepts and practical applications in the field The book provides an in depth treatment of the foundations of Artificial Intelligence AI Machine Learning and Data Analytics DA It also includes many of AI DA applications in oil and gas reservoirs exploration development and production The book covers the basic technical details on many tools used in smart oil fields This includes topics such as pattern recognition neural networks fuzzy logic evolutionary computing expert systems artificial intelligence machine learning human computer interface natural language processing data analytics and next generation visualization While theoretical details will be kept to the minimum these topics are introduced from oil and gas applications viewpoints In this volume many case histories from the recent applications of intelligent data to a number of different oil and gas problems are highlighted The applications cover a wide spectrum of practical problems from exploration to drilling and field development to production optimization artificial lift and secondary recovery Also the authors demonstrate the effectiveness of intelligent data analysis methods in dealing with many oil and gas problems requiring combining machine and human intelligence as well as dealing with linguistic and imprecise data and rules

Computational Intelligence Processing in Medical Diagnosis Manfred Schmitt,Horia-Nicolai Teodorescu,Ashlesha Jain,Ajita Jain,Sandhya Jain,2013-11-11 Computational intelligence techniques are gaining momentum in the medical prognosis and diagnosis This volume presents advanced applications of machine intelligence in medicine and bio medical engineering Applied methods include knowledge bases expert systems neural networks neuro fuzzy systems evolvable systems wavelet transforms and specific internet applications The volume is written in view of explaining to the practitioner the fundamental issues related to computational intelligence paradigms and to offer a fast and friendly managed introduction to the most recent methods based on computer intelligence in medicine

Aggregation Operators Tomasa

Calvo, Gaspar Mayor, Radko Mesiar, 2012-12-06 1 The increasing number of research papers appeared in the last years that either make use of aggregation functions or contribute to its theoretical study assess its growing importance in the field of Fuzzy Logic and in others where uncertainty and imprecision play a relevant role. Since these papers are published in many journals, few books and several proceedings of conferences books on aggregation are particularly welcome. To my knowledge, *Aggregation Operators: New Trends and Applications* is the first book aiming at generality and I take it as a honour to write this Foreword in response to the gentle demand of its editors Radko Mesiar, Tomasa Calvo and Gaspar Mayor. My pleasure also derives from the fact that twenty years ago I was one of the first Spaniards interested in the study of aggregation functions and this book includes work by several Spanish authors. The book contains nice and relevant original papers authored by some of the most outstanding researchers in the field and since it can serve as the editors point out in the Preface as a small handbook on aggregation, the book is very useful for those entering the subject for the first time. The book also contains a part dealing with potential areas of application so it can be helpful in gaining insight on the future developments.

*Intelligent Agents and Their Applications* Zhengxin Chen, Nikhil Ichalkaranje, 2013-03-20 Intelligent agents are one of the most promising business tools in our information rich world. An intelligent agent consists of a software system capable of performing intelligent tasks within a dynamic and unpredictable environment. They can be characterised by various attributes including autonomous, adaptive, collaborative, communicative, mobile and reactive. Many problems are not well defined and the information needed to make decisions is not available. These problems are not easy to solve using conventional computing approaches. Here the intelligent agent paradigm may play a major role in helping to solve these problems. This book, written for application researchers, covers a broad selection of research results that demonstrate in an authoritative and clear manner the applications of agents within our information society.

**Practical Issues of Intelligent Innovations** Vassil Sgurev, Vladimir Jotsov, Janusz Kacprzyk, 2018-07-05 This book presents recent advances in the field of intelligent systems. Composed of fourteen selected chapters, it covers a wide range of research that varies from applications in industrial data science to those in applied science. Today the word INNOVATION is more and more connected with the words INTELLIGENT and SECURITY as such the book discusses the theory and applications of hot topics such as big data, education, applications of robots with different levels of autonomy, knowledge based modeling and control of complex dynamical systems, sign based synthesis of behavior, security issues with intelligent systems, innovative intelligent control design, neuromorphic computation, data driven classification, intelligent modeling and measurement innovations, multisensor data association, personal education assistants, a modern production architecture, study of peer review and scientometrics, intelligent research on bug report data and clustering non Gaussian data. The broad and varied research discussed represents the mainstream of contemporary intelligent innovations that are slowly but surely changing the world.

**Advances in Computational Intelligence** Ignacio Rojas, Gonzalo Joya, Joan Cabestany, 2013-06-20 This two volume set LNCS 7902 and

7903 constitutes the refereed proceedings of the 12th International Work Conference on Artificial Neural Networks IWANN 2013 held in Puerto de la Cruz Tenerife Spain in June 2013 The 116 revised papers were carefully reviewed and selected from numerous submissions for presentation in two volumes The papers explore sections on mathematical and theoretical methods in computational intelligence neurocomputational formulations learning and adaptation emulation of cognitive functions bio inspired systems and neuro engineering advanced topics in computational intelligence and applications

*Neural Networks and Other Soft Computing Techniques with Applications in the Oil Industry* Fred Aminzadeh, Paul De Groot, 2006      **Recent Trends in Computational Intelligence Enabled Research** Siddhartha Bhattacharyya, Paramartha Dutta, Debabrata Samanta, Anirban Mukherjee, Indrajit Pan, 2021-07-31 The field of computational intelligence has grown tremendously over that past five years thanks to evolving soft computing and artificial intelligent methodologies tools and techniques for envisaging the essence of intelligence embedded in real life observations Consequently scientists have been able to explain and understand real life processes and practices which previously often remain unexplored by virtue of their underlying imprecision uncertainties and redundancies and the unavailability of appropriate methods for describing the incompleteness and vagueness of information represented With the advent of the field of computational intelligence researchers are now able to explore and unearth the intelligence otherwise insurmountable embedded in the systems under consideration Computational Intelligence is now not limited to only specific computational fields it has made inroads in signal processing smart manufacturing predictive control robot navigation smart cities and sensor design to name a few Recent Trends in Computational Intelligence Enabled Research Theoretical Foundations and Applications explores the use of this computational paradigm across a wide range of applied domains which handle meaningful information Chapters investigate a broad spectrum of the applications of computational intelligence across different platforms and disciplines expanding our knowledge base of various research initiatives in this direction This volume aims to bring together researchers engineers developers and practitioners from academia and industry working in all major areas and interdisciplinary areas of computational intelligence communication systems computer networks and soft computing Provides insights into the theory algorithms implementation and application of computational intelligence techniques Covers a wide range of applications of deep learning across various domains which are researching the applications of computational intelligence Investigates novel techniques and reviews the state of the art in the areas of machine learning computer vision soft computing techniques

Meta-attributes and Artificial Networking Kalachand Sain, Priyadarshi Chinmoy Kumar, 2022-06-24 Applying machine learning to the interpretation of seismic data Seismic data gathered on the surface can be used to generate numerous seismic attributes that enable better understanding of subsurface geological structures and stratigraphic features With an ever increasing volume of seismic data available machine learning augments faster data processing and interpretation of complex subsurface geology Meta Attributes and Artificial Networking A New Tool for Seismic Interpretation explores how

artificial neural networks can be used for the automatic interpretation of 2D and 3D seismic data Volume highlights include Historic evolution of seismic attributes Overview of meta attributes and how to design them Workflows for the computation of meta attributes from seismic data Case studies demonstrating the application of meta attributes Sets of exercises with solutions provided Sample data sets available for hands on exercises The American Geophysical Union promotes discovery in Earth and space science for the benefit of humanity Its publications disseminate scientific knowledge and provide resources for researchers students and professionals      **Geostatistical Reservoir Modeling** Michael J. Pyrcz, Clayton V.

Deutsch, 2014-05 A revised edition that provides a full update on the most current methods tools and research in petroleum geostatistics      *Fuzzy Partial Differential Equations and Relational Equations* Masoud Nikravesh, Lofti A. Zadeh, Victor Korotkikh, 2013-04-17 During last decade significant progress has been made in the oil industry by using soft computing technology Underlying this evolving technology there have been ideas transforming the very language we use to describe problems with imprecision uncertainty and partial truth These developments offer exciting opportunities but at the same time it is becoming clearer that further advancements are confronted by fundamental problems The whole idea of how human process information lies at the core of the challenge There are already new ways of thinking about the problems within theory of perception based information This theory aims to understand and harness the laws of human perceptions to dramatically improve the processing of information A matured theory of perception based information is likely to be properly positioned to contribute to the solution of the problems and provide all the ingredients for a revolution in science technology and business In this context Berkeley Initiative in Soft Computing BISC University of California Berkeley from one side and Chevron Texaco from another formed a Technical Committee to organize a Meeting entitled State of the Art Assessment and New Directions for Research to understand the significance of the fields accomplishments new developments and future directions The Technical Committee selected and invited 15 scientists and oil industry experts as technical committee members from the related disciplines to participate in the Meeting which took place at the University of California Berkeley and March 15-17 2002      **Possibility for Decision** Christer Carlsson, Robert Fuller, 2011-07-25 This book starts with the basic concepts of fuzzy sets and progresses through a normative view on possibility distributions and OWA operators in multiple criteria decisions Five applications that all build on experience from solving complex real world problems of possibility distributions to strategic decisions about closing not closing a production plant using fuzzy real options portfolio selection with imprecise future data predictive probabilities and possibilities for risk assessment in grid computing fuzzy ontologies for process industry and design and implementation of mobile value services are presented and carefully discussed It can be useful for researchers and students working in soft computing real options fuzzy decision making grid computing knowledge mobilization and mobile value services

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