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# Neural Algorithm For Solving Differential Equations

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Optical Bistability: Controlling Light With Light

Contact Problems in Elasticity

Proceedings of Fourth International Conference on Soft Computing for Problem Solving

20th International Conference, ICAISC 2021, Virtual Event, June 21-23, 2021, Proceedings, Part I

16th International Symposium on Neural Networks, ISNN 2019, Moscow, Russia, July 10-12, 2019, Proceedings, Part I

An Introduction to Applied Mathematics

Volume 1

Applied Stochastic Differential Equations

Mathematical Methods in Interdisciplinary Sciences

Convergent Cognitive Information Technologies

Advances in Computational Intelligence Systems

Modeling and Control of Uncertain Nonlinear Systems with Fuzzy Equations and Z-Number

21st International Conference, Cagliari, Italy, September 13-16, 2021, Proceedings, Part IV

Semi-empirical Neural Network Modeling and Digital Twins Development

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Theory, Methods and Applications

Computational Science and Its Applications - ICCSA 2021

A Study of Variational Inequalities and Finite Element Methods

Third International Conference, Convergent 2018, Moscow, Russia, November 29 - December 2, 2018, Revised Selected Papers

Solving Ordinary Differential Equations

Artificial Neural Networks for Engineers and Scientists

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Augmented Lagrangian and Operator Splitting Methods in Nonlinear Mechanics

Intelligent Information and Database Systems

17th International Conference, Porto, Portugal, September 9-13, 2007, Proceedings, Part II

Optimizing Methods and Tools  
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Artificial Neural Networks - ICANN 2007  
Artificial Neural Networks as Models of Neural Information Processing  
Differential Equations and Their Applications  
Handbook of Exact Solutions for Ordinary Differential Equations  
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Computational Science - ICCS 2001  
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Selected Papers from the XXI International Conference on Neuroinformatics, October 7-11, 2019, Dolgoprudny, Moscow Region, Russia  
Artificial Intelligence and Soft Computing  
Mathematical Methods in Interdisciplinary Sciences  
VLSI Implementation of a Cellular Neural Network for Solving Partial Differential Equations

*Neural Algorithm For Solving  
Differential Equations*

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## **KELLEY MORENO**

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*Optical Bistability: Controlling Light With Light* Cambridge  
University Press

Semi-empirical Neural Network Modeling presents a new approach on how to quickly construct an accurate, multilayered neural network solution of differential equations. Current neural network methods have significant disadvantages, including a lengthy learning process and single-layered neural networks built on the finite element method (FEM). The strength of the new method presented in this book is the automatic inclusion of task parameters in the final solution formula, which eliminates the need for repeated problem-solving. This is especially important

for constructing individual models with unique features. The book illustrates key concepts through a large number of specific problems, both hypothetical models and practical interest. Offers a new approach to neural networks using a unified simulation model at all stages of design and operation Illustrates this new approach with numerous concrete examples throughout the book Presents the methodology in separate and clearly-defined stages  
Contact Problems in Elasticity Springer

For the past several years the Division of Applied Mathematics at Brown University has been teaching an extremely popular sophomore level differential equations course. The immense success of this course is due primarily to two factors. First, and foremost, the material is presented in a manner which is rigorous enough for our mathematics and applied mathematics majors, but yet intuitive and practical enough for our engineering,

biology, economics, physics and geology majors. Secondly, numerous case histories are given of how researchers have used differential equations to solve real life problems. This book is the outgrowth of this course. It is a rigorous treatment of differential equations and their applications, and can be understood by anyone who has had a two semester course in Calculus. It contains all the material usually covered in a one or two semester course in differential equations. In addition, it possesses the following unique features which distinguish it from other textbooks on differential equations.

Proceedings of Fourth International Conference on Soft Computing for Problem Solving CRC Press

The constant evolution of the calculation capacity of the modern computers implies in a permanent effort to adjust the existing numerical codes, or to create new codes following new points of view, aiming to adequately simulate fluid flows and the related transport of physical properties. Additionally, the continuous improving of laboratory devices and equipment, which allow to record and measure fluid flows with a higher degree of details, induces to elaborate specific experiments, in order to shed light in unsolved aspects of the phenomena related to these flows. This volume presents conclusions about different aspects of calculated and observed flows, discussing the tools used in the analyses. It contains eighteen chapters, organized in four sections: 1) Smoothed Spheres, 2) Models and Codes in Fluid Dynamics, 3) Complex Hydraulic Engineering Applications, 4) Hydrodynamics and Heat/Mass Transfer. The chapters present results directed to the optimization of the methods and tools of Hydrodynamics.

**20th International Conference, ICAISC 2021, Virtual Event, June 21-23, 2021, Proceedings, Part I** Springer Nature

Differential equations play a vital role in the fields of engineering and science. Problems in engineering and science can be modeled using ordinary or partial differential equations. Analytical solutions of differential equations may not be obtained easily, so numerical methods have been developed to handle them. Machine intelligence methods, such as Artificial Neural Networks (ANN), are being used to solve differential equations, and these methods are presented in *Artificial Neural Networks for Engineers and Scientists: Solving Ordinary Differential Equations*. This book shows how computation of differential equation becomes faster once the ANN model is properly developed and applied.

*16th International Symposium on Neural Networks, ISNN 2019, Moscow, Russia, July 10-12, 2019, Proceedings, Part I* John Wiley & Sons

This book describes different mathematical modeling and soft computing techniques used to solve practical engineering problems. It gives an overview of the current state of soft computing techniques and describes the advantages and disadvantages of soft computing compared to traditional hard computing techniques. Through examples and case studies the editors demonstrate and describe how problems with inherent uncertainty can be addressed and eventually solved through the aid of numerical models and methods. The chapters address several applications and examples in bioengineering science, drug delivery, solving inventory issues, Industry 4.0, augmented reality and weather forecasting. Other examples include solving

fuzzy-shortest-path problems by introducing a new distance and ranking functions. Because, in practice, problems arise with uncertain data and most of them cannot be solved exactly and easily, the main objective is to develop models that deliver solutions with the aid of numerical methods. This is the reason behind investigating soft numerical computing in dynamic systems. Having this in mind, the authors and editors have considered error of approximation and have discussed several common types of errors and their propagations. Moreover, they have explained the numerical methods, along with convergence and consistence properties and characteristics, as the main objectives behind this book involve considering, discussing and proving related theorems within the setting of soft computing. This book examines dynamic models, and how time is fundamental to the structure of the model and data as well as the understanding of how a process unfolds • Discusses mathematical modeling with soft computing and the implementations of uncertain mathematical models • Examines how uncertain dynamic systems models include uncertain state, uncertain state space and uncertain state's transition functions • Assists readers to become familiar with many soft numerical methods to simulate the solution function's behavior This book is intended for system specialists who are interested in dynamic systems that operate at different time scales. The book can be used by engineering students, researchers and professionals in control and finite element fields as well as all engineering, applied mathematics, economics and computer science interested in dynamic and uncertain systems. Ali Ahmadian is a Senior Lecturer at the Institute of IR 4.0, The National University

of Malaysia. Soheil Salahshour is an associate professor at Bahcesehir University.

*An Introduction to Applied Mathematics* Springer Nature

This book consists of select proceedings of the National Conference on Wave Mechanics and Vibrations (WMVC 2018). It covers recent developments and cutting-edge methods in wave mechanics and vibrations applied to a wide range of engineering problems. The book presents analytical and computational studies in structural mechanics, seismology and earthquake engineering, mechanical engineering, aeronautics, robotics and nuclear engineering among others. This book can be useful for students, researchers, and professionals interested in the wide-ranging applications of wave mechanics and vibrations.

*Volume 1* CRC Press

This book presents the proceedings of the 24th European Conference on Artificial Intelligence (ECAI 2020), held in Santiago de Compostela, Spain, from 29 August to 8 September 2020. The conference was postponed from June, and much of it conducted online due to the COVID-19 restrictions. The conference is one of the principal occasions for researchers and practitioners of AI to meet and discuss the latest trends and challenges in all fields of AI and to demonstrate innovative applications and uses of advanced AI technology. The book also includes the proceedings of the 10th Conference on Prestigious Applications of Artificial Intelligence (PAIS 2020) held at the same time. A record number of more than 1,700 submissions was received for ECAI 2020, of which 1,443 were reviewed. Of these, 361 full-papers and 36 highlight papers were accepted (an acceptance rate of 25% for full-papers and 45% for highlight papers). The book is divided into

three sections: ECAI full papers; ECAI highlight papers; and PAIS papers. The topics of these papers cover all aspects of AI, including Agent-based and Multi-agent Systems; Computational Intelligence; Constraints and Satisfiability; Games and Virtual Environments; Heuristic Search; Human Aspects in AI; Information Retrieval and Filtering; Knowledge Representation and Reasoning; Machine Learning; Multidisciplinary Topics and Applications; Natural Language Processing; Planning and Scheduling; Robotics; Safe, Explainable, and Trustworthy AI; Semantic Technologies; Uncertainty in AI; and Vision. The book will be of interest to all those whose work involves the use of AI technology.

#### **Applied Stochastic Differential Equations** Springer

The aim of this book is to handle different application problems of science and engineering using expert Artificial Neural Network (ANN). As such, the book starts with basics of ANN along with different mathematical preliminaries with respect to algebraic equations. Then it addresses ANN based methods for solving different algebraic equations viz. polynomial equations, diophantine equations, transcendental equations, system of linear and nonlinear equations, eigenvalue problems etc. which are the basic equations to handle the application problems mentioned in the content of the book. Although there exist various methods to handle these problems, but sometimes those may be problem dependent and may fail to give a converge solution with particular discretization. Accordingly, ANN based methods have been addressed here to solve these problems. Detail ANN architecture with step by step procedure and algorithm have been included. Different example problems are

solved with respect to various application and mathematical problems. Convergence plots and/or convergence tables of the solutions are depicted to show the efficacy of these methods. It is worth mentioning that various application problems viz. Bakery problem, Power electronics applications, Pole placement, Electrical Network Analysis, Structural engineering problem etc. have been solved using the ANN based methods.

#### *Mathematical Methods in Interdisciplinary Sciences* Springer Science & Business Media

This book constitutes the refereed proceedings of the Third International Conference on Convergent Cognitive Information Technologies, Convergent 2018, held in Moscow, Russia, in December 2018. The 26 revised full papers and 9 short papers were carefully reviewed and selected from 147 submissions. The papers of this volume are organized in topical sections on theoretical questions of computer science, computational mathematics, computer science and cognitive information technologies; cognitive information technologies in control systems; big data and applications; the Internet of Things (IoT): standards, communication and information technologies, network applications; smart cities: standards, cognitive-information technologies and their applications.- cognitive information technologies in the digital economics.- digital transformation of transport.

#### **Convergent Cognitive Information Technologies** Springer

A guide to the new research in the field of fractional order analysis Fractional Order Analysis contains the most recent research findings in fractional order analysis and its applications. The authors—noted experts on the topic—offer an examination of

the theory, methods, applications, and the modern tools and techniques in the field of fractional order analysis. The information, tools, and applications presented can help develop mathematical methods and models with better accuracy. Comprehensive in scope, the book covers a range of topics including: new fractional operators, fractional derivatives, fractional differential equations, inequalities for different fractional derivatives and fractional integrals, fractional modeling related to transmission of Malaria, and dynamics of Zika virus with various fractional derivatives, and more. Designed to be an accessible text, several useful, relevant and connected topics can be found in one place, which is crucial for an understanding of the research problems of an applied nature. This book: Contains recent development in fractional calculus Offers a balance of theory, methods, and applications Puts the focus on fractional analysis and its interdisciplinary applications, such as fractional models for biological models Helps make research more relevant to real-life applications Written for researchers, professionals and practitioners, Fractional Order Analysis offers a comprehensive resource to fractional analysis and its many applications as well as information on the newest research.

*Advances in Computational Intelligence Systems* CRC Press

The contact of one deformable body with another lies at the heart of almost every mechanical structure. Here, in a comprehensive treatment, two of the field's leading researchers present a systematic approach to contact problems. Using variational formulations, Kikuchi and Oden derive a multitude of new results, both for classical problems and for nonlinear problems involving large deflections and buckling of thin plates with unilateral

supports, dry friction with nonclassical laws, large elastic and elastoplastic deformations with frictional contact, dynamic contacts with dynamic frictional effects, and rolling contacts. This method exposes properties of solutions obscured by classical methods, and it provides a basis for the development of powerful numerical schemes. Among the novel results presented here are algorithms for contact problems with nonlinear and nonlocal friction, and very effective algorithms for solving problems involving the large elastic deformation of hyperelastic bodies with general contact conditions. Includes detailed discussion of numerical methods for nonlinear materials with unilateral contact and friction, with examples of metalforming simulations. Also presents algorithms for the finite deformation rolling contact problem, along with a discussion of numerical examples.

Modeling and Control of Uncertain Nonlinear Systems with Fuzzy Equations and Z-Number Springer

This book presents state-of-the-art technical contributions based around one of the most successful evolutionary optimization algorithms published to date: Harmony Search. Contributions span from novel technical derivations of this algorithm to applications in the broad fields of civil engineering, energy, transportation & mobility and health, among many others and focus not only on its cross-domain applicability, but also on its core evolutionary operators, including elements inspired from other meta-heuristics. The global scientific community is witnessing an upsurge in groundbreaking, new advances in all areas of computational intelligence, with a particular flurry of research focusing on evolutionary computation and bio-inspired optimization. Observed processes in nature and sociology have

provided the basis for innovative algorithmic developments aimed at leveraging the inherent capability to adapt characterized by various animals, including ants, fireflies, wolves and humans. However, it is the behavioral patterns observed in music composition that motivated the advent of the Harmony Search algorithm, a meta-heuristic optimization algorithm that over the last decade has been shown to dominate other solvers in a plethora of application scenarios. The book consists of a selection of the best contributions presented at ICHSA, a major biannual event where leading global experts on meta-heuristic optimization present their latest findings and discuss the past, present, and future of the exciting field of Harmony Search optimization. It provides a valuable reference resource for researchers working in the field of optimization meta-heuristics, and a solid technical base for frontline investigations around this algorithm.

*21st International Conference, Cagliari, Italy, September 13–16, 2021, Proceedings, Part IV* World Scientific

LNCS volumes 2073 and 2074 contain the proceedings of the International Conference on Computational Science, ICCS 2001, held in San Francisco, California, May 27–31, 2001. The two volumes consist of more than 230 contributed and invited papers that reflect the aims of the conference to bring together researchers and scientists from mathematics and computer science as basic computing disciplines, researchers from various application areas who are pioneering advanced application of computational methods to sciences such as physics, chemistry, life sciences, and engineering, arts and humanitarian fields, along with software developers and vendors, to discuss problems and

solutions in the area, to identify new issues, and to shape future directions for research, as well as to help industrial users apply various advanced computational techniques.

Semi-empirical Neural Network Modeling and Digital Twins Development Elsevier

Stochastic differential equations are differential equations whose solutions are stochastic processes. They exhibit appealing mathematical properties that are useful in modeling uncertainties and noisy phenomena in many disciplines. This book is motivated by applications of stochastic differential equations in target tracking and medical technology and, in particular, their use in methodologies such as filtering, smoothing, parameter estimation, and machine learning. It builds an intuitive hands-on understanding of what stochastic differential equations are all about, but also covers the essentials of It calculus, the central theorems in the field, and such approximation schemes as stochastic Runge-Kutta. Greater emphasis is given to solution methods than to analysis of theoretical properties of the equations. The book's practical approach assumes only prior understanding of ordinary differential equations. The numerous worked examples and end-of-chapter exercises include application-driven derivations and computational assignments. MATLAB/Octave source code is available for download, promoting hands-on work with the methods.

Advances in Neural Computation, Machine Learning, and Cognitive Research III Springer Nature

An original, systematic-solution approach to uncertain nonlinear systems control and modeling using fuzzy equations and fuzzy differential equations There are various numerical and analytical

approaches to the modeling and control of uncertain nonlinear systems. Fuzzy logic theory is an increasingly popular method used to solve inconvenience problems in nonlinear modeling. *Modeling and Control of Uncertain Nonlinear Systems with Fuzzy Equations and Z-Number* presents a structured approach to the control and modeling of uncertain nonlinear systems in industry using fuzzy equations and fuzzy differential equations. The first major work to explore methods based on neural networks and Bernstein neural networks, this innovative volume provides a framework for control and modeling of uncertain nonlinear systems with applications to industry. Readers learn how to use fuzzy techniques to solve scientific and engineering problems and understand intelligent control design and applications. The text assembles the results of four years of research on control of uncertain nonlinear systems with dual fuzzy equations, fuzzy modeling for uncertain nonlinear systems with fuzzy equations, the numerical solution of fuzzy equations with Z-numbers, and the numerical solution of fuzzy differential equations with Z-numbers. Using clear and accessible language to explain concepts and principles applicable to real-world scenarios, this book: Presents the modeling and control of uncertain nonlinear systems with fuzzy equations and fuzzy differential equations Includes an overview of uncertain nonlinear systems for non-specialists Teaches readers to use simulation, modeling and verification skills valuable for scientific research and engineering systems development Reinforces comprehension with illustrations, tables, examples, and simulations *Modeling and Control of Uncertain Nonlinear Systems with Fuzzy Equations and Z-Number* is suitable as a textbook for advanced students,

academic and industrial researchers, and practitioners in fields of systems engineering, learning control systems, neural networks, computational intelligence, and fuzzy logic control.

*Transputing in Numerical and Neural Network Applications* BoD - Books on Demand

The aim of this B is to design fast thesisd forward neural networks to present a method to solve initial value problem for ordinary differential equations. That is to develop an algorithm which can speedup the solution times, reduce solver failures, and increase possibility of obtaining the globally optimal solution. The applicability of this approach ranges from single ordinary differential equations, to systems of ordinary differential equations with initial condition . Also, a variant types of compute the search direction k of conjugate gradient training algorithm are introduced and we describing several different training algorithms, many modified and new algorithms have been proposed for training Feed Forward Neural Network(FFNN), many of them having a very fast convergence rate for reasonable size networks. In all of these algorithms we use the gradient of the performance function( energy function) to determine how to adjust the weights such that the performance function is minimized, where the back propagation algorithm has been used to increase the speed of training. Finally, we illustrate the method by solving a variety of model problems."

*Theory, Methods and Applications* Frontiers Media SA

This book presents the latest trends in and approaches to computational intelligence research and its application to intelligent systems. It covers a long list of interconnected research areas, such as fuzzy systems, neural networks,



evolutionary computation, clustering and classification, machine learning, data mining, cognition and robotics, and deep learning. The individual chapters are based on peer-reviewed contributions presented at the 18th Annual UK Workshop on Computational Intelligence (UKCI-2018), held in Nottingham, UK on September 5-7, 2018. The book puts a special emphasis on novel methods and reports on their use in a wide range of applications areas, thus providing both academics and professionals with a comprehensive and timely overview of new trends in computational intelligence.

**Computational Science and Its Applications - ICCSA 2021**  
IOS Press

An examination of the use of transputers in numerical computing and neural networks. Topics covered include linear systems of equations and programming, fluid and molecular dynamics simulation, transformations, Kalman filtering and general numerical problems. Neural networks are discussed in terms of algorithms and simulation.

*A Study of Variational Inequalities and Finite Element Methods* An Introduction to Neural Network Methods for Differential Equations Brings mathematics to bear on your real-world, scientific problems Mathematical Methods in Interdisciplinary Sciences

provides a practical and usable framework for bringing a mathematical approach to modelling real-life scientific and technological problems. The collection of chapters Dr. Snehashish Chakraverty has provided describe in detail how to bring mathematics, statistics, and computational methods to the fore to solve even the most stubborn problems involving the intersection of multiple fields of study. Graduate students, postgraduate students, researchers, and professors will all benefit significantly from the author's clear approach to applied mathematics. The book covers a wide range of interdisciplinary topics in which mathematics can be brought to bear on challenging problems requiring creative solutions. Subjects include: Structural static and vibration problems Heat conduction and diffusion problems Fluid dynamics problems The book also covers topics as diverse as soft computing and machine intelligence. It concludes with examinations of various fields of application, like infectious diseases, autonomous car and monotone inclusion problems.

Third International Conference, Convergent 2018, Moscow, Russia, November 29 - December 2, 2018, Revised Selected Papers Academic Press

An Introduction to Neural Network Methods for Differential Equations Springer

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