

PROCEEDINGS OF SPIE

***Second International  
Conference on Applied Statistics,  
Computational Mathematics,  
and Software Engineering  
(ASCMSE 2023)***

**Yudong Zhang  
Paulo Batista**  
*Editors*

**26–28 May 2023  
Kaifeng, China**

*Organized by*  
Henan University (China)

*Sponsored by*  
University of Évora (Portugal)  
AEIC Academic Exchange Information Centre (China)

*Published by*  
SPIE

**Volume 12784**

Proceedings of SPIE 0277-786X, V. 12784

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at [SPIDigitalLibrary.org](http://SPIDigitalLibrary.org).

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Second International Conference on Applied Statistics, Computational Mathematics, and Software Engineering (ASCMSE 2023)*, edited by Yudong Zhang, Paulo Batista, Proc. of SPIE 12784, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510668188

ISBN: 9781510668195 (electronic)

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time)

[SPIE.org](http://SPIE.org)

Copyright © 2023 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at [copyright.com](http://copyright.com). Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL  
LIBRARY**

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

# Contents

xi *Conference Committee*

---

## APPLIED STATISTICS AND RISK MANAGEMENT

---

- 12784 02 **Application of difference method to Mw9.0 earthquake in Japan and Ms8.1 earthquake in Nepal** [12784-52]
- 12784 03 **Strength analysis of perforated casing under non-uniform in-situ stress in ultra-deep wells** [12784-149]
- 12784 04 **Research on optimal design of reaction conditions based on mixed statistical model** [12784-75]
- 12784 05 **Anomalous transport of active particles under quenched disorder** [12784-144]
- 12784 06 **Mathematical analysis of deterministic and stochastic SIQRS models** [12784-62]
- 12784 07 **Transient behaviour of heterogeneous diffusion processes in the cubic potential** [12784-148]
- 12784 08 **Classification model for mental health of employees based on variable encoder techniques** [12784-17]
- 12784 09 **Online physician selection research based on the prospect-regret theory** [12784-143]
- 12784 0A **Positive equilibrium global stability annotation for the Leslie-Gower predator prey model with self-feeding prey** [12784-166]
- 12784 0B **Joint inversion of TEM and CT by local cross-gradient in full space** [12784-147]
- 12784 0C **The principle and state-of-art applications of self-similar structure** [12784-165]
- 12784 0D **Statistical inference of integer valued time series based on signed thinning operator of symbolic generalized power series in random environment** [12784-82]
- 12784 0E **A reliable climate model based on Gaussian process** [12784-141]
- 12784 0F **Research on anti-breast cancer candidate drugs analysis based on random forest model and genetic algorithm** [12784-153]
- 12784 0G **Classification and prediction model of ancient glass based on AP-CART** [12784-162]
- 12784 0H **Dynamic risk assessment of oil and gas pipeline failure based on DBN model** [12784-98]

- 12784 OI **Information sharing in supply chain based on products return and game theory** [12784-81]
- 12784 OJ **Risk assessment of shared electric vehicles participating in backup services** [12784-112]
- 12784 OK **Research on categorical prediction of diabetes based on XGBoost** [12784-5]
- 12784 OL **Research on the optimization method of multi-subject noncooperative game for coupled electricity-carbon system for efficient new energy consumption** [12784-32]
- 12784 OM **Research and application of risk assessment and monitoring and early warning technology for oil and gas storage and transportation pipelines** [12784-117]
- 12784 ON **Comparative analysis of damage ability of new ammunition of ground artillery to single armored target** [12784-109]
- 12784 OO **A multi-objective consensus community detection algorithm based on Whale algorithm** [12784-79]
- 12784 OP **Probability analysis of seismic risk in the northern edge of the West Qinling fault based on the temporal and spatial evolution of Coulomb stress** [12784-37]
- 12784 OQ **Probability forecasting of earthquake disaster risk in Guanzhong-Tianshui economic zone** [12784-38]
- 12784 OR **A prediction model of urban fire with grey Markov model** [12784-12]
- 12784 OS **A color image encryption scheme based on block compressive sensing and chaotic systems** [12784-94]
- 12784 OT **Combat capability graphical description method by ontology extension UML** [12784-102]
- 12784 OU **A classification and identification system for recyclable waste in university campuses based on WeChat mini programs** [12784-63]
- 12784 OV **A beam scanning array for enhancing V2X security** [12784-68]

---

#### COMPUTATIONAL GEOMETRY AND MATHEMATICAL LOGIC ANALYSIS

- 12784 OW **Study on the physical detection method of discriminating edible oil based on viscosity coefficient** [12784-173]
- 12784 OX **Perturbative Schwinger-Dyson-equations-of-motion for quantum spins  $1/2$ : Ising model of two spins in filled fields** [12784-154]
- 12784 OY **The method of the ternary complex based on three-variable rational interpolation function** [12784-16]

- 12784 0Z **Airport topography design method for two-dimensional one-net functions on a three-dimensional warped surface** [12784-51]
- 12784 10 **New inequalities for  $M$ -matrices involving fan product** [12784-151]
- 12784 11 **Artificial intelligence-assisted physical design of fusion materials** [12784-146]
- 12784 12 **Global variance reduction method based on volume and non-counting area corrections for global Monte Carlo simulations** [12784-160]
- 12784 13 **The relationship between Kneser-Süss inequality and Minkowski inequality in mixed discriminant** [12784-157]
- 12784 14 **A geometric progression of the masses of elementary fermions** [12784-91]
- 12784 15 **Project cycle budget evaluation based on least squares** [12784-139]
- 12784 16 **Research on the application of improved genetic algorithm in computer mathematical modeling** [12784-20]
- 12784 17 **A MATLAB-based model for calculating the take-off capacity of a single runway** [12784-92]
- 12784 18 **The reliability calculation method of on-board electro-mechanical components based on test data** [12784-77]
- 12784 19 **An efficient method for solving a least square problem over mixed constraints** [12784-113]
- 12784 1A **The efficiency analysis of logistics industry in three northern regions based on three-stage DEA model** [12784-50]
- 12784 1B **Digital core reconstruction for shale gas reservoirs based on Markov chain-Monte Carlo method and large-field splicing technology** [12784-28]
- 12784 1C **A two-level linearized scheme for two-dimensional Riesz space fractional nonlinear advection-dispersion equations** [12784-57]
- 12784 1D **A weighted multivariate combination time series forecasting model** [12784-114]
- 12784 1E **Detection of outliers in air pollution from Shijiazhuang using functional data analysis** [12784-88]
- 12784 1F **LSTM network implementation on news sentiment analysis** [12784-161]
- 12784 1G **Research on the calculation method of electric vehicle charging station coverage** [12784-95]
- 12784 1H **On the integral points of a special elliptic curve** [12784-142]
- 12784 1I **Matrix inequalities for the Hadamard product of matrices** [12784-29]

- 12784 1J **Texture image classification method based on improved bilinear model** [12784-73]
- 12784 1K **Semantic segmentation of remote sensing image based on Contextual U-Net** [12784-59]
- 12784 1L **A deep sum-score clustering diagnosis method** [12784-61]
- 12784 1M **Mathematical analyses of quasi active set strategy for quadratic programming using affine mapping** [12784-85]
- 12784 1N **Workload balance-aware edge server placement in mobile edge computing** [12784-58]
- 12784 1O **Apple object detection in natural environment based on YOLO v5** [12784-25]
- 12784 1P **A multi-objective community detection algorithm based on ant lion optimization** [12784-72]
- 12784 1Q **An overview of the application and development of data integrity verification techniques** [12784-34]
- 12784 1R **The influencing factors analysis on road container transport freight index in Ningbo based on Spearman and VAR model** [12784-23]
- 12784 1S **Chemical composition classification of glass relics study based on statistical testing and clustering algorithms** [12784-168]

---

#### SOFTWARE ARCHITECTURE MODELING AND DECISION SUPPORT

---

- 12784 1T **Analysis of joint distribution and intelligent express cabinet location based on K-means clustering algorithm** [12784-7]
- 12784 1U **Modeling and investigation of simultaneous terahertz communication and RF energy transmission** [12784-67]
- 12784 1V **Numerical conformal mappings from multiply connected regions onto slit domains using the charge simulation method** [12784-171]
- 12784 1W **Simulation study on the influence of metro occupation construction on road capacity of mixed traffic intersection** [12784-80]
- 12784 1X **The dynamic bifurcation of the Brusselator model in two-dimensional region** [12784-152]
- 12784 1Y **Dynamic behavior of seal rock based upon vibration model of circular plate for initial rock breaking stage** [12784-167]
- 12784 1Z **Design of electrical resistivity monitoring instrument collection system in coal mine** [12784-150]
- 12784 20 **Bilateral FS-UNet: a logging image feature segmentation model based on depth learning** [12784-84]

- 12784 21 **Research on evaporation duct profile basing on model A** [12784-136]
- 12784 22 **Research on the analysis method of power grid technology transformation input based on multi-hierarchy structure tree** [12784-119]
- 12784 23 **A hybrid heuristic scheduling method for FMSs based on timed Petri nets** [12784-40]
- 12784 24 **Research on dynamic allocation method for airport gate based on capacity relaxation** [12784-101]
- 12784 25 **The convergence analysis of the AOR-type iterative method in preconditioned for the new splitting** [12784-158]
- 12784 26 **A new conjecture: the high-order difference of prime sequence approximately obeys the normal distribution** [12784-159]
- 12784 27 **Research on dynamic volume rendering technology for dose field of nuclear facilities** [12784-115]
- 12784 28 **Prediction model of questionnaire survey based on database feature clustering** [12784-126]
- 12784 29 **Design and technical analysis of alarm device in electric power construction inspection system** [12784-86]
- 12784 2A **Study on buckling load analysis model of buried steel pipeline** [12784-24]
- 12784 2B **Design and implementation of a physical asset analysis and evaluation system for power grid** [12784-9]
- 12784 2C **Pre-transaction verification method for adapting to the continuous operation of power medium- and long-term market** [12784-170]
- 12784 2D **Reliability allocation method for natural gas pipelines considering hydrothermal processes for pipeline natural gas transmission** [12784-169]
- 12784 2E **Unreal engine nanite foliage shadow imposter** [12784-104]
- 12784 2F **A rockfill particle breakage evolution model for predicting gradation changes** [12784-69]
- 12784 2G **County power balance method based on wind and water storage and charging** [12784-107]
- 12784 2H **An improved IVHF-TOPSIS method based on hesitancy degree** [12784-43]
- 12784 2I **Demand forecast of aviation spare parts based on grey model** [12784-110]
- 12784 2J **A distributed carbon metering terminal ad-hoc network communication routing technology** [12784-134]

- 12784 2K **Research on Stewart platform design evaluation based on data-driven and entropy weight-gray correlation** [12784-39]
- 12784 2L **Image quality assessment based on aesthetic evaluation** [12784-33]
- 12784 2M **Research on course recommendation technology based on behavior log of online education platform** [12784-103]
- 12784 2N **Risk quantitative classification method of non-coal underground mine based on multi-source data** [12784-36]
- 12784 2O **Factor analysis of COVID-19 in China based on modal decomposition and independent component analysis** [12784-48]
- 12784 2P **Early warning model of illegal E-cigarette sales based on network public opinion analysis** [12784-70]

---

#### COMPUTER AIDED AND INTELLIGENT SYSTEM EVALUATION

---

- 12784 2Q **Python implementation of Glauber Monte Carlo model** [12784-174]
- 12784 2R **Two-phase control chart monitoring binomial high-dimensional data streams** [12784-138]
- 12784 2S **Electric power training simulation platform based on virtual reality technology** [12784-27]
- 12784 2T **Flight time-driven characteristics of departing passenger aggregation** [12784-105]
- 12784 2U **Hierarchical feature learning network for salient object detection** [12784-19]
- 12784 2V **A system of predator-prey dynamical behaviors with impulsive effects** [12784-56]
- 12784 2W **Text classification methods based on knowledge graph and BERT** [12784-128]
- 12784 2X **Fault diagnosis and prediction model of building lightning protection system based on BIM and machine learning** [12784-54]
- 12784 2Y **Teaching platform of resonant system based on the hybrid programming of MATLAB and C++** [12784-93]
- 12784 2Z **Pipeline leakage location technology based on SA-PSO algorithm** [12784-99]
- 12784 30 **Assessing heart disease severeness via machine learning techniques** [12784-135]
- 12784 31 **Research methods on telecom user churn** [12784-108]
- 12784 32 **Traffic flow study on CA I5-N from Santa Ana to Anaheim** [12784-97]



- 12784 33 **Construction of comprehensive application platform for intelligent teaching of photoshop course under cloud platform** [12784-31]
- 12784 34 **The Linux based body falls alarm system** [12784-106]
- 12784 35 **Development of cloud automation evaluation system based on typical ADAS functions** [12784-137]
- 12784 36 **Research on intelligent monitoring and fault early warning control system of slag transport system** [12784-71]
- 12784 37 **Research on communication signal waveform technology of aerospace telemetry track and command network based on polynomial regression** [12784-46]
- 12784 38 **Research on illegal access behavior control of heterogeneous cloud resources based on lifecycle characteristics** [12784-8]
- 12784 39 **Research on RUL prediction method for state space systems based on auxiliary particle filtering algorithm** [12784-53]
- 12784 3A **Improved BP neural network based on genetic algorithm** [12784-78]
- 12784 3B **Task scheduling algorithm based on security and trusted monitoring of domestic Kunpeng architecture processor** [12784-26]
- 12784 3C **Evaluation and optimization of data systems** [12784-111]
- 12784 3D **SELinux-based operating system security research** [12784-21]
- 12784 3E **Overview of security access control mechanisms** [12784-41]
- 12784 3F **Optimizing recommender system using federated clustering** [12784-35]
- 12784 3G **FL4C<sup>2</sup>: a trustworthy intelligent cloud computing for private machine learning** [12784-49]
- 12784 3H **Lightweight small target detection algorithm based on YOLOv5** [12784-60]
- 12784 3I **Key node recognition based on mixed degree decomposition method** [12784-125]
- 12784 3J **A stochastic proximal alternating minimization algorithm for nonnegative matrix decomposition** [12784-55]