



科学出版社

一门科学只有在成功地运用数学时，  
才算达到了真正完善的地步。

——马克思

ISSN 1000-0984



RE8

Q K 2 1 4 3 7 5 6

# 数学的实践与认识

MATHEMATICS

IN PRACTICE AND THEORY

第五十一卷

第21期

Vol. 51

No. 21

2021

中国数学会会刊  
中国科学院数学与系统科学研究院主办  
科学出版社出版

# 数学的实践与认识

2021年第51卷第21期

## 目 次

### 管理科学

- 原油集输系统多层级能效评价体系研究 ..... 汤 晟, 庞艳萍, 黎志敏, 张学强, 孙 巍 (1)  
基于博弈交叉 DEA 的山东省农业生态效率评价研究 ..... 李晶洁, 郭昭铭, 孙云鹏, 蒋硕凡 (9)  
基于矩估计经验似然的公共交通对经济增长的影响分析 ..... 吴和成, 卢维学, 万里洋 (21)  
甘肃新型城镇化旅游业生态经济耦合协调的时空演化研究 .....  
刘利利, 杨秀平, 牛 晶, 张 华, 张晓波 (29)  
线上专柜模式下样品与成品联合销售策略研究 ..... 殷 哲, 赵 琳 (44)  
基于 Stackelberg 博弈的 4PL 主导下的冷链物流融通仓融资模式研究 ..... 马树建, 董倩倩, 程显达 (55)  
不确定碳税下考虑原材料替代的低碳闭环供应链网络设计 ..... 管 倩, 杨玉香 (68)  
基于小波周期和 FGM(1,1) 模型的机场空气质量预测研究 ..... 张 耀, 王 湛, 于 女, 张梦雅, 唐思嘉 (82)  
区间型效益 - 成本型多属性决策联系数算法 ..... 刘宗宝, 陆广地 (93)  
基于 EW-UMT 的旧工业厂区再生利用价值评估研究 ..... 李 勤, 李文龙, 鄂天畅 (101)  
基于广义 DEA 的中国西部地区县域脱贫工作效率研究 ..... 苏日娜, 马占新 (109)  
网络外部性和公平关切下三级 ESC 的广告、服务与定价决策 ..... 王玉燕, 李 华, 申 亮 (119)  
基于灰色关联模型的众创社区绩效评价研究 ..... 康亚飞, 党耀国, 王俊杰, 冯 宇 (133)  
基于投入补贴和产量补贴的企业社会责任激励机制研究 ..... 凌亚群, 沙成磊 (143)

### 工 程

- SA-AGA-ELM 的 PM<sub>2.5</sub> 浓度预测模型研究 ..... 陈优良, 陶剑辉, 王兆茹, 陈 洋 (156)  
基于改进层次分析法、熵权法的深基坑施工风险评估 .....  
蒙国往, 丘洪彬, 吴 波, 黄劲松, 徐世祥, 刘 毅 (167)

### 应 用

- 高维协方差矩阵的两目标收缩估计 ..... 罗肖强, 肖维忠 (177)  
基于案例推理的直升机事故案例库构建 ..... 尚金秋, 纪 媛, 王星州 (182)  
融合直觉梯形模糊集相似度的多准则决策模型研究 ..... 曹吉祥, 江文奇 (191)  
决策形式背景的双向决策规则研究 ..... 汪秋分, 卞洪亚 (198)  
基于信息准则的 Gumbel 分布变点检测模型及其应用 ..... 蔡 霞, 樊 培 (207)  
一类具有新参数的最优跳频序列 ..... 周 峡, 李 燕 (216)  
轨道交通弯道设计中缓和曲线的精细计算方法 ..... 张合沛, 周振建, 褚长海, 万建军, 赵永成, 宋士仓 (222)

### 研 究

- 一类二阶非线性无穷多点边值问题的正解 ..... 王 峰, 张辉明 (229)  
单位球上 Bergman 空间中的 Toeplitz 代数性质 ..... 陈建军, 徐广侠, 尹明凯 (236)  
含参数集值向量优化问题强有效点集的连通性 ..... 赖遵远, 陈剑尘, 刘富荣 (242)  
具有连续分布时滞的四阶微分方程的振动性 ..... 贾对红 (250)  
关于非齐次树指标马氏双链转移矩阵的强偏差定理 ..... 金少华, 田雪然, 杨会明 (258)  
Hardy-Morrey 鞍空间的混合型原子分解及其应用 ..... 陶昌玲, 于 林 (264)

### 教学研究

- 具有空变系数和吸收项的非局部反应扩散抛物方程在非线性边界条件下解的爆破现象 .....  
欧阳柏平, 肖胜中, 朱芳芳 (271)  
机坪滑行方案安全评估 ..... 廖 勇 (280)  
考虑资源共享的物流服务平台定价策略及影响 ..... 丁雪峰, 李艳茹, 蒋坤珍 (288)  
一类凸调和函数的系数不等式和增长性质 ..... 张晓丽, 李书海 (296)  
泄漏时滞神经网络的改进滞后状态反馈控制 ..... 韩彦武, 汤红吉 (303)

# MATHEMATICS IN PRACTICE AND THEORY

2021 Vol.51 No. 21

## Contents

### Managed Science

- Study on Multi Level Energy Efficiency Evaluation System of Crude Oil Gathering and Transportation System ..... TANG Sheng, PANG Yan-ping, LI Zhi-min, ZHANG Xue-qiang, SUN Wei (1)
- Evaluation of Agricultural Ecological Efficiency in Shandong Province Based on Game Cross DEA ..... LI Jing-jie, GUO Zhao-ming, SUN Yun-peng, JIANG Shuo-fan (9)
- The Impact of Public Transport on Economic Growth Based on Empirical Likelihood for Moment Conditions ..... WU He-cheng, LU Wei-xue, WAN Li-yang(21)
- Study on Spatial and Temporal Evolution of the Integrated and Coordinated Degree of New Urbanization, Tourism, Ecology and Regional Economy: a case study of Gansu Province ..... LIU Li-li, YANG Xiu-ping, NIU Jing, ZHANG Hua, ZHANG Xiao-bo (29)
- The Joint Sales Policy of Samples and Finished Products For the Online Counters ..... YIN Zhe, ZHAO Lin(44)
- Research on 4PL-led Financing Mode of Cold Chain Logistics Financing Warehouse Based on Stackelberg Game ..... MA Shu-jian, DONG Qian-qian, CHENG Xian-da (55)
- Closed-loop Supply Chain Network Design Considering Raw Material Substitution Under Uncertain Carbon Tax ..... GUAN Qian, YANG Yu-xiang (68)
- Research on Airport Air Quality Forecast Based on Wavelet Period and FGM(1,1) Model ..... ZHANG Yao, WANG Zhan, YU Nu, ZHANG Meng-ya, TANG Si-jia (82)
- Interval Benefit-Cost Multi-Attribute Decision-making Algorithm Based on Binary Connection Number ..... LIU Zong-bao, LU Guang-di (93)
- Research on Value Assessment for the Regeneration of old Industrial Areas Based on EW-UMT ..... LI Qin, LI Wen-long, E Tian-chang (101)
- Research on the Efficiency of County Poverty Alleviation in Western China Based on Generalized DEA Model ..... Surina, MA Zhan-xin (109)
- Advertising, Service and Pricing Decision-making of Three-level ESC Under Network Externalities and Fairness Concerns ..... WANG Yu-yan, LI Hua, SHEN Liang (119)
- Research on Performance Evaluation of Mass Innovation Community Based on Grey Correlation Model ..... KANG Ya-fei, DANG Yao-guo, WANG Jun-jie, FENG Yu (133)
- Research on Corporate Social Responsibility Incentive Mechanism Based on Input Subsidy and Output Subsidy ..... LING Ya-qun, SHA Cheng-lei (143)

### Engineering

- Research on PM2.5 Concentration Prediction Model of AGACombination SA Optimization ELM ..... CHEN You-liang, TAO Jian-hui, WANG Zhao-ru, CHEN Yang (156)
- Risk Evaluation of Deep Foundation Pit Construction Based on Improved Analytic Hierarchy Process and Entropy Method ..... MENG Guo-wang, QIU Hong-bin, WU Bo, HUANG Jing-song, XU Shi-xiang, LIU Yi (167)

### Applications

- Two-target Shrinkage Estimation of High-dimensional Covariance Matrix ..... LUO Xiao-qiang, XIAO Wei-zhong (177)
- Construction of Helicopter Accident Case Based on Case Reasoning ..... SHANG Jin-qi, JI Yuan, WANG Xing-zhou (182)
- Research on Fuzzy Multi-criteria Decision-making Model Based on Similarity of Intuitionistic Trapezoidal Fuzzy Sets ..... CAO Ji-xiang, JIANG Wen-qi (191)
- Research on Bidirectional Decision Rules in Decision Formal Context ..... WANG Qiu-fen, BIAN Hong-ya (198)
- Change-point Model and Its Applications of the Gumbel Distribution Based on Information Criteria ..... CAI Xia, FAN Pei (207)
- A Class of Optimal Frequency-Hopping Sequences with New Parameters ..... ZHOU Xia, LI Yan (216)
- An Intensive Computing Method for Easement Curve in Orbit Curving Road Design ..... ZHANG He-pei, ZHOU Zhen-jian, CHU Chang-hai, WAN Jian-jun, ZHAO Yong-cheng, SONG Shi-cang (222)

### Research

- Existence of Positive Solutions for a Second Order Nonlinear  $\infty$ -point Boundary Value Problems ..... WANG Feng, ZHANG Hui-ming (229)
- Some Properties of Toeplitz Algebra on the Bergman Space of Unit Ball ..... CHEN Jian-jun, XU Guang-xia, YIN Ming-kai (236)
- The Connectedness of Strong Effective Point Set for Set-valued Vector Optimization Problems with Parameters ..... LAI Zun-yuan, CHEN Jian-chen, LIU Fu-rong (242)
- Oscillation of Fourth Order Differential Equationswith Continuously Distributed Delay ..... JIA Dui-hong (250)
- A Strong Deviation Theorem for the Transition Matrix of Double Markov Chains Indexed by a Non-Homogeneous Tree ..... JIN Shao-hua, TIAN Xue-ran, YANG Hui-ming (258)
- Mixed Atomic Decomposition of Martingale Hardy-Morrey Spaces and Their Applications ..... TAO Chang-ling, YU Lin (264)

### Teaching Research

- Blow-up Phenomena of Solutions to a Nonlocal Reaction-diffusion Parabolic Equation with Space-dependent Coefficients and Inner Absorption Terms Under Nonlinear Boundary Conditions ..... OUYANG Bai-ping, XIAO Sheng-zhong, ZHU Fang-fang (271)
- Safety Assessment of Apron Taxiing Schemes ..... LIAO Yong (280)
- Pricing policies for Sharing Resource and their influence on Logistics Service Platform ..... DING Xue-feng, LI Yan-ru, JIANG Kun-zhen (288)
- The Coefficient Inequalities and Growth Properties for a class of Convex Harmonic Functions ..... ZHANG Xiao-li, LI Shu-hai (296)
- Improved Delayed State-feedback Control For Stabilization of Neural Networks with Leakage Delay ..... HAN Yan-wu, TANG Hong-ji (303)

# 《数学的实践与认识》编辑委员会

主 编：林 群

副主编：(以下按姓氏笔划为序)

卢 焱 叶其孝 朱广田(常务副主编)

李邦河 汪寿阳 宋春伟 张继平

编 委：王 术 王冬琳 王建明 龙永红 叶 专

史福贵 冯荣权 朱一心 许 进 李 宁

余志坤 张文岭 林源渠 郑连存 姜启源

骆顺龙 贾仲孝 郭懋正 唐仲伟 黄海洋

常彦勋

## 数学的实践与认识

Shuxue de Shijian yu Renshi

(半月刊)

第51卷

第21期

2021年11月

Journal of Mathematics in Practice and Theory

(Semimonthly)

Vol.51 No.21 November 2021

编 辑 中国数学会

《数学的实践与认识》编委会

地 址：北京大学数学科学学院

邮政编码：100871

电 话：(86-10)62759981

电子邮件：bjmath@math.pku.edu.cn

Edited by

Editorial Board of

Mathematics in Practice and Theory

School of Mathematical Sciences, PKU

Beijing 100871, China

Tel:(86-10)62759981

Email:bjmath@math.pku.edu.cn

LIN Qun

Editor in Chief

Chinese Academy of Sciences

Superintended by

Academy of Mathematics and

Sponsored by

Systems Science, Chinese Academy

of Sciences

Co-sponsored by

Institute of Systems Science, Academy of

Mathematics and Systems Science,

Chinese Academy of Sciences

Beijing Mathematical Society

Science Press

16 Donghuangchenggen North Street,

Beijing 100717, China

主 编 林 群

主管 单位 中国科学院

主办 单位 中国科学院数学与系统科学研究院

承 办 单位 中国科学院系统科学研究所

北京数学会

Published by

Printing House of Wenlian in China

出 版 科 学 出 版 社

北京东黄城根北街16号

Printed by

Beijing Post Office

邮 政 编 码：100717

Distributed at Home by

China International Book Trading

印 刷 中国文联印刷厂

Corporation (CIBTC) P.O.Box 399,

国 内 发 行 北京市邮局

Beijing, China

国 外 发 行 中国国际图书贸易总公司

All Local Post Office

(北京399信箱)

国 内 订 购 全国各地邮局

ISSN 1000-0984

ISSN 1000-0984

国外发行代号Q47

定 价：人民币35.00元

CN11-2018/O1

国内发行代号2-809



21>

9 771000 098212