# 华东师范大学｜数学科学学院
School of Mathematical Sciences, East China Normal University

# 组合优化研讨会

# 程

# 序

# 册

主办单位：华东师范大学数学科学学院

数学与工程应用教育部重点实验室

2026 年 3 月 13 日 – 2026 年 3 月 15 日

# 2026年华东师范大学组合优化研讨会

2026 年 3 月 13 日 – 2026 年 3 月 15 日，上海

组合优化作为运筹学与理论计算机科学的重要分支，近年来在理论研究与实际应用中均取得了长足的发展，特别是在与人工智能、智能制造等国家重大战略需求的交叉融合中不断焕发出新的活力。为集中展示组合优化领域的最新研究进展与应用成果，进一步推动组合数学、运筹学及智能决策等相关方向的学术交流与深度合作，探讨该领域的前沿热点与未来发展趋势，华东师范大学数学科学学院将于 2026 年 3 月 13 日至 15 日在上海举办"2026 华东师范大学组合优化学术研讨会"。

本次研讨会旨在为国内相关领域的专家学者、青年教师及同行搭建一个高水平的学术交流平台，分享最新科研成果，激发创新思维。我们诚挚地邀请您拨冗出席本次研讨会，您的到来定将为本次会议增添光彩，由衷感谢您对本次研讨会的鼎力支持！

**会议时间：** 2026 年 3 月 13 日 – 2026 年 3 月 15 日

**会议地点：** 华东师范大学闵行校区数学楼 102 报告厅

**会议组织委员会主任：** 吕长虹

**会议组织委员会委员 (按姓氏拼音排序)：** 杜若霞、何家林、王祥丰、徐孜立、叶青杰、袁龙图、詹兴致

**会议联系人：** 叶青杰 (qjye@math.ecnu.edu.cn)

# 日程安排

| 3 月 13 日 | | | | |
|---|---|---|---|---|
| 13:00–18:00 | 报到地点：艺悦酒店大堂（上海市闵行区吴泾尚义路 39 弄 1 号） | | | |
| 18:00–20:00 | 晚餐（地点：宝龙艺悦酒店） | | | |
| **3 月 14 日** | | | | |
| 会议地点：华东师范大学闵行校区数学楼 102 报告厅 | | | | |
| 时间 | 报告人 | 题目 | | 主持人 |
| 9:00-9:10 | 开幕式：华东师范大学校长助理兼本科生院院长吕长虹教授致辞 | | | |
| 9:10-9:50 | 李建平 | Approximation algorithms for solving the family prize-collecting traveling salesman problem | | 徐大川 |
| 9:50–10:20 | 合影与茶歇 | | | |
| 10:20–11:00 | 唐中正 | When does additional information lead to longer travel time in multi-origin destination networks? | | 胡觉亮 |
| 11:00–11:40 | 罗俊杰 | Strategyproof multi-resource allocation for cloud computing under divisible and indivisible task models | | 杨文国 |
| 12:00–13:00 | 午餐（地点：华东师范大学闵行校区夏雨厅） | | | |
| 14:30–15:10 | 程郁琨 | Altruism, collectivism and egalitarianism: On a variety of prosocial behaviors in binary networked public goods games | | 张晓岩 |
| 15:10–15:50 | 徐孜立 | Interlacing polynomial method for CUR matrix approximation problem | | 吴晨晨 |
| 15:50–16:10 | 茶歇 | | | |
| 16:10–16:50 | 叶青杰 | Online trading — secretary vs prophet | | 张新功 |
| 16:50–17:40 | 组合优化前沿问题交流（盖玲，刘朝晖，王长军，王晨豪，许宜诚） | | | 张　涌 |
| 18:00–20:00 | 晚餐（地点：宝龙艺悦酒店） | | | |
| **3 月 15 日** | | | | |
| 8:30–11:30 | 自由讨论与交流 | | | |
| 11:30–13:00 | 午餐（地点：宝龙艺悦酒店） | | | |

# 报告摘要

## Approximation algorithms for solving the family prize-collecting traveling salesman problem

李建平

*云南大学*

**摘要：** In this talk, we propose the family prize-collecting traveling salesman problem (the FPcTSP), which is a further generalization of the prize-collecting traveling salesman problem (the PcTSP). Concretely, given a complete undirected graph $G = (V, E; w, f, p; r)$ with a root $r \in V$ and a vertex-set partition $V = \{r\} \uplus V_1 \uplus V_2 \uplus \cdots \uplus V_t$, where $w : E \to \mathbb{R}_0^+$ is a weight function that satisfies the triangle inequality, $f : \{V_1, V_2, \ldots, V_t\} \to \mathbb{Z}^+$ is an admissible function that satisfies $f(V_i) \leq |V_i|$ for each $i = 1, 2, \ldots, t$, and $p : \{V_1, V_2, \ldots, V_t\} \to \mathbb{R}_0^+$ is a penalty function, we are asked to find a cycle $C$, starting and ending at the same root $r$, such that, for each cluster $V_i$ ($i = 1, 2, \ldots, t$), this cycle $C$ visits either $f(V_i)$ vertices in $V_i$, or no vertex in $V_i$, but it only incurs a penalty $p(V_i)$, the objective is to minimize the total weight of $C$ plus the summation of penalties for clusters skipped by $C$, *i.e.*, $\min\{\sum_{e \in C} w(e) + \sum_{i: V_i \cap C = \emptyset} p(V_i)\}$. Especially, when $p(V_i) = +\infty$ for each $i = 1, 2, \ldots, t$, the FPcTSP becomes the family traveling salesman problem (the FTSP), and when $f(V_i) = 1$ for each $i = 1, 2, \ldots, t$, the FPcTSP becomes the group prize-collecting traveling salesman problem (the GPcTSP). In addition, we consider a variation of the FPcTSP, which is referred as to the restricted family prize-collecting traveling salesman problem (the RFPcTSP), *i.e.*, we only add the constraint that this cycle $C$ must consecutively visit $f(V_i)$ vertices within $V_i$ for each $i = 1, 2, \ldots, t$. Especially, when $p(V_i) = +\infty$ for each $i = 1, 2, \ldots, t$, the RFPcTSP becomes the restricted family traveling salesman problem (the RFTSP).

We obtain the following five main results. (1) We design a $\frac{3\alpha+5}{2}$-approximation algorithm to solve the FPcTSP in polynomial time, where $\alpha = \max\{|V_i| - f(V_i) \mid i = 1, 2, \ldots, t\}$. (2) We provide a $(\frac{3\beta}{2} + 1)$-approximation algorithm to solve the GPcTSP in polynomial time, where $\beta = \max\{|V_i| \mid i = 1, 2, \ldots, t\}$, which improves the previous approximation ratio of $(2 - \frac{1}{n-1})\beta$ for an instance with its maximal cluster having a sufficiently large size. (3) We present a $\frac{3\alpha+3}{2}$-approximation algorithm to solve the FTSP in polynomial time. (4) We give a $(3\gamma + 2)$-approximation algorithm to solve the RFPcTSP in polynomial time, where $\gamma = \max\{\beta(\beta - 1), 2\beta\}$. (5) We give an $O(\log^2 n \log \log n \log t)$-approximation algorithm to solve the RFTSP in polynomial time.

报告人简介：李建平，教授，博士生导师，法国巴黎南大学计算机科学专业博士。云南省"百人计划"入选者，云南省教学名师，云南省中青年学术和技术带头人，云南省有突出贡献专家。

# Altruism, Collectivism and Egalitarianism: On a Variety of Prosocial Behaviors in Binary Networked Public Goods Games

程郁琨

*江南大学*

摘要：Binary Networked public goods (BNPG) game consists of a network G= (V, E) with n players residing as nodes in a network and making a YES/NO decision to invest a public project. Examples of such public projects include face mask wearing during a pandemic, crime reporting and vaccination, etc. Most of the conventional modes of BNPG games solely posit egoism as the motivation of players: they only care about their own benefits. However, a series of real-world examples show that people have a wide range of prosocial behaviors in making decisions. To address this property, we introduce a novel extension of BNPG games to account for three kinds of prosocial motivations: altruism, collectivism, and egalitarianism. We revise utility functions to reflect different prosocial motivations with respect to the welfare of others, mediated by a prosocial graph.

We develop computational complexity results to decide the exisence of pure strategy Nash equilibrium in these models, for cases where the prosocial graph is a tree, a clique or a general network. We further discuss the Prosocial Network Modification (PNM) problem, in which a principal can change the network structure within a budget constraint, to induce a given strategy profile with respect to an equilibrium. For all three types of PNM problems, we completely characterize their corresponding computational complexity results.

报告人简介：程郁琨：博士，博士生导师，江南大学商学院教授。中国运筹学会理事兼副秘书长、中国工业与应用数学学会区块链专委会秘书长、中国计算机学会计算经济学专委会副主任，江苏省运筹学会理事，担任《运筹学学报》《运筹与管理》《Journal of Dynamics and Games》《Blockchain》等期刊编委。主要研究领域为组合优化、博弈论、运筹优化等。曾主持国家自然科学基金项目 4 项，省部级科研项目 2 项。在运筹学领域国际顶级刊物 MOR，博弈论领域顶级期刊 GEB，计算机科学领域重要国际期刊 IEEE TCC、IEEE TC、TCS，计算经济学领域国际顶级会议 EC、WINE、WWW，区块链领域顶级国际会议 FC 2022，人工智能领域顶级会议 IJCAI 上发表高水平学术论文 80 余篇，获得发明专利 2 项。江苏省"科技副总"，江苏省高校"青蓝工程"中青年学术带头人，江苏省高校"青蓝工程"优秀青年骨干教师。获得江苏省第十八届哲学社会科学优秀成果奖三等奖，2021 年度江苏省高等学校科学技术研究成果奖三等奖。无锡市委二十届三中全会精神宣讲团、二十届四中全会宣讲团成员。

# When does additional information lead to longer travel time in multi-origin destination networks?

唐中正

北京邮电大学

**摘要：** The Informational Braess' Paradox (IBP) illustrates a counterintuitive scenario where revelation of additional roadway segments to some self-interested travelers leads to increased travel times for these individuals. IBP extends the original Braess' paradox by relaxing the assumption that all travelers have identical and complete information about the network. In this talk, we study the conditions under which IBP does not occur in networks with non-atomic selfish travelers and multiple origin-destination pairs. Our results completely characterize the network topologies immune to IBP, thus resolving an open question proposed by Acemoglu et al.

**报告人简介：** 唐中正现为北京邮电大学数学科学学院副教授。他在 2025 年 2 月至 2026 年 2 月期间访问华威大学商学院。他于 2020 年获得中国科学院数学与系统科学研究院和香港城市大学博士学位。研究方向为组合优化、图论和算法博弈论。

# Strategyproof multi-resource allocation for cloud computing under divisible and indivisible task models

罗俊杰

北京交通大学

**摘要：** We study multi-resource allocation with Leontief utilities in cloud computing. The canonical mechanism，Dominant Resource Fairness (DRF)，satisfies sharing incentive (SI)，envy-freeness (EF)，strategyproofness (SP)，and Pareto optimality (PO)，but can be highly inefficient under the classical utilitarian approximation ratio；indeed，under this benchmark，no mechanism satisfying these properties can achieve a better worst-case guarantee. This limitation motivates the recently introduced fair-ratio benchmark，which compares a mechanism only against optimal allocations satisfying SI and EF. Within this benchmark，we introduce a unified parametric mechanism design framework that captures previous mechanisms as special cases. By tuning the parameters to the instance structure，we obtain new mechanisms that preserve SI，EF，SP，and PO and improve the best previously known asymptotic fair-ratio from $\frac{4}{3}$ to $\frac{9}{8}$. We also initiate the study of fair-ratio guarantees for indivisible tasks. Since SI，EF，SP，and PO cannot be achieved simultaneously in this setting，we focus on SI，EF1，and SP，and propose a DRF-style mechanism with constant fair-ratio 6. In contrast，we show that several natural extensions of efficient mechanisms designed for divisible tasks fail to remain strategyproof in the indivisible setting. Joint work with Yunpeng Lou.

**报告人简介：** 罗俊杰，北京交通大学数学与统计学院讲师、硕导。现任中国运筹学会博弈论分会青年理事，CCF 理论计算机科学专委会、计算经济学专委会执行委员。2014 年毕业于浙江大学数学系，2019 年获中国科学院数学与系统科学研究院博士学位，之后在德国柏林工业大学和新加坡南洋理工大学从事博士后研究。主要研究方向为组合优化与算法博弈论，成果发表于 Mathematics of Operations Research、Games and Economic Behavior、Algorithmica、Information and Computation，以及 WINE、AAAI、IJCAI 等期刊和会议。

# Interlacing Polynomial Method for CUR Matrix Approximation Problem

徐孜立

华东师范大学

**摘要：** Given a target matrix, the CUR matrix approximation problem seeks a low-rank approximation of the target matrix formed by selecting a subset of its columns and rows, with the goal of minimizing the spectral norm of the residual matrix. Using the interlacing polynomials method, we derive a sharper spectral-norm error bound than many existing results. We further present a deterministic polynomial-time algorithm for CUR matrix approximation problem under certain matrix conditions. A key technical contribution in this work is an extension of the classical interlacing polynomials framework to handle polynomials of different degrees. Finally, we apply the proposed framework to a generalized CUR approximation setting, where the columns and rows are allowed to be selected from arbitrary given matrices. This provides a more flexible framework for matrix approximation.

**报告人简介：** 徐孜立，华东师范大学数学科学学院副教授。他在 2021 年 7 月从中科院计算数学所获得博士学位，在 2021 年 8 月至 2024 年 8 月在香港科技大学数学系担任博士后。他的研究兴趣主要在应用计算调和分析、逼近论和离散数学中的组合优化问题等，近年来的工作主要在矩阵逼近和相位恢复等问题，主要成果发表在如 FoCM, Math Comp, ACHA, JFA, IMRN 等杂志上。

# Online trading — secretary vs prophet

叶青杰

华东师范大学

**摘要：** In this talk, we study an online trading model featuring the decision making of the intermediary who interacts with both sellers and buyers. Each seller has one item, and each buyer demands one. Each agent (seller or buyer) possesses a valuation for the homogeneous item. The agents arrive sequentially in a uniformly random order to meet the intermediary and reveal their values as prices upon their arrivals. The intermediary must make an irrevocable trading decision (either buying from a seller or selling to a buyer) immediately after learning the agent's price, before the next agent's arrival.

We examine two versions of this online trading problem. The first is a secretary-like version, which seeks to maximize the social welfare of all agents generated by the trading, without prior knowledge of the price distributions. The second is a prophet version, which, assuming the intermediary knows the i.i.d. price distributions of the agents, aims to maximize the trader's gain-from-trade. For these two versions of the problem, we design algorithms and analyze their competitive ratios.

**报告人简介：** 叶青杰，华东师范大学明园晨辉学者（讲师），博士毕业于华东师范大学。博士毕业后曾在中国科学院数学与系统科学研究院从事博士后工作。主要的研究方向为组合优化与图论，成果发表在 J. Comb. Optim., Discrete Appl. Math., J. Oper. Res. Soc. China. 等期刊上，曾获得中俄数学挑战基金。

# 华东师范大学数学科学学院简介

华东师范大学的数学学科具有悠久的历史和广泛影响力，是学校的传统优势学科，在教育部最新一轮学科评估中取得优秀成绩。学院拥有数学学科一级博士点和数学教育博士点，数学博士后流动站，国家理科基础科学人才培养和科学研究基地，"数学与工程应用"教育部重点实验室，上海市核心数学与实践重点实验室，上海市首批"海外高层次人才创新创业基地"和若干个数学专门研究中心。

目前，数学科学学院拥有一支以多位国际著名数学家、数学教育家为领军人物，以中青年骨干数学家为主体的科研、教学队伍，包括 1 位国际数学家大会 (ICM) 45 分钟报告者，8 位国家级高层次人才计划入选者，9 位国家级高层次青年人才计划入选者。

学院研究方向齐全、科研实力雄厚，近年来学院教师获得教育部自然科学奖二等奖、上海市科技进步特等奖、科学探索奖、萧树铁应用数学奖、保罗厄多斯奖等重要奖项; 承担国家重点研发计划项目、国家自然科学基金重点项目、新基石研究员项目、上海市"科技创新行动计划"以及华为、上港集团、唐山港、中交信科等企业委托项目。

# 数学与工程应用教育部重点实验室简介

数学与工程应用教育部重点实验室聚焦智慧交通工程和近海与生态工程中的数学需求展开理论和应用研究，以问题为导向，落地应用为目标，开展问题驱动的数学研究和数学应用，深入研究问题背后的数学理论以期更广泛的应用。实验室依托上海区位优势，服务国家和上海地区区域建设发展需求。

实验室整合华东师范大学代数研究中心、偏微分方程研究中心、几何分析研究中心、应用数学与交叉中心等校级研究平台，凝聚重点发展方向，精准对接国家战略，提升产学研协同创新能力和承接国家和地方重大重点项目的能力。在基础研究方面，注重聚焦具有应用前景的前沿基础问题，用基础数学提供数学应用的颠覆性技术。在应用数学方面，开展以问题驱动的应用数学研究，为国家和地区创新发展提供数学支撑。
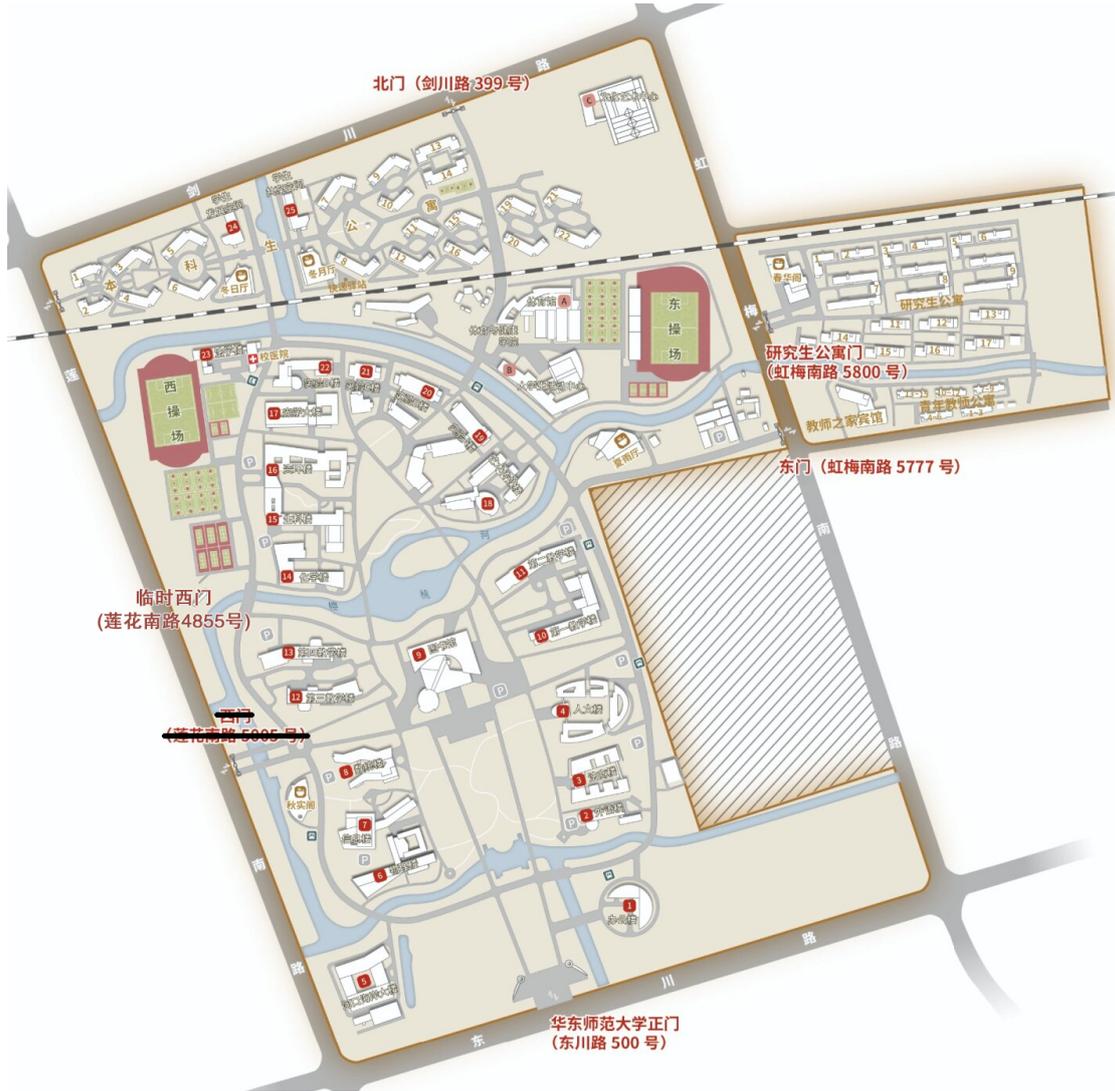
# 交通信息



图 1: 华东师范大学闵行校区校园地图

图 2: 从宝龙艺悦酒店到数学楼的建议步行路线