香 港 大 學
THE UNIVERSITY OF HONG KONG

HKSTS 香港交通研究學會

ENGINEERING Management

Hong Kong Society for Transportation Studies

2025 International Symposium on *Smart Mobility Systems*

Pre-Conference (HKSTS) Workshop

Jointly organized by

Department of Civil Engineering & Department of Data and Systems Engineering & Institute of Transport Studies, The University of Hong Kong

The Hong Kong Society for Transportation Studies (HKSTS)

Engineering Management (originally named as *Frontiers of Engineering Management*), a Springer Nature journal supervised by the Chinese Academy of Engineering

Date: 6 December 2025 (Saturday)

Time: 13:00 – 18:00

Venue: CPD-3.04, Centennial Campus, Central Podium Levels - Three (CPD-3, Run Run Shaw Tower), The University of Hong Kong

Aims and Scopes

This workshop centers on Smart Mobility, emphasizing the integration of advanced technologies and intelligent systems to create efficient, sustainable, and user-centric transport solutions. With the rise of emerging modes such as urban air traffic and shared autonomous vehicles, new challenges are reshaping traffic operations and planning. The workshop aims to foster discussion on innovative approaches that enhance mobility accessibility and system resilience. We welcome both local and overseas scholars to attend the workshop for exchanging their ideas and insights!

Co-chairs

Dr. Jintao KE (kejintao@hku.hk), Department of Civil Engineering, The University of Hong Kong

Dr. Fangni ZHANG (fnzhang@hku.hk), Department of Data and Systems Engineering, The University of Hong Kong

Dr. Ryan C. P. WONG (cpwryan@hku.hk), Department of Civil Engineering, The University of Hong Kong

Secretary

Dr. Bin ZHOU (binchou@hku.hk), Department of Civil Engineering, The University of Hong Kong

Registration: free admission but registration is required. All are welcome. When you enter HKU, please show the registration confirmation page to the campus guard.

香 港 大 學 THE UNIVERSITY OF HONG KONG

HKSTS 香港交通研究學會

ENGINEERING Management

Hong Kong Society for Transportation Studies

2025 International Symposium on *Smart Mobility Systems*

Pre-Conference (HKSTS) Workshop

Tentative Workshop Programme on 6 December 2025

Time	Event
13:00-13:05	**Opening Address** Dr. Jintao Ke
13:05 –13:45	**Sensitivity of ITS Learning Models with Mobility Data** **- *applications in transportation privacy and cybersecurity*** *Xuegang Ban*, William and Marilyn Conner Endowed Professor, Department of Civil and Environmental Engineering, The University of Washington
13:45 –14:25	**Exact Methods through Decomposition: Insights from Logic-Based Benders Decomposition** *Roberto Baldacci*, Professor, College of Science and Engineering, Hamad Bin Khalifa University
14:25 – 15:05	**Physics-informed data analytics - exploiting domain knowledge with hard data in a transportation network** *Yueyue Fan*, Professor, Department of Civil and Environmental Engineering, University of California, Davis
15:05 – 15:45	**From Self-Driving to Self-Organizing: Connected Vehicles as Catalysts for Smart Mobility** *Lina Kattan*, Professor, Schulich School of Engineering, University of Calgary
15:45 – 16:00	**Break**
16:00 – 16:40	**Disturbance Mitigation Strategies for Scheduled Mobility Systems** *Fang He*, Tenured Associate Professor, Department of Industrial Engineering, Tsinghua University
16:40 – 17:20	**Coordinated urban logistics: Combining public transit and drones for efficient distribution** *Kai Wang*, Associate Professor, School of Vehicle and Mobility, Tsinghua University
17:20 – 18:00	**Joint Online Freight Allocation and Train Unit Scheduling with Reusable Resources for Emergency Logistics** *Jiateng Yin*, Professor, School of Systems Science, Beijing Jiaotong University

香 港 大 學
THE UNIVERSITY OF HONG KONG

HKSTS 香港交通研究學會

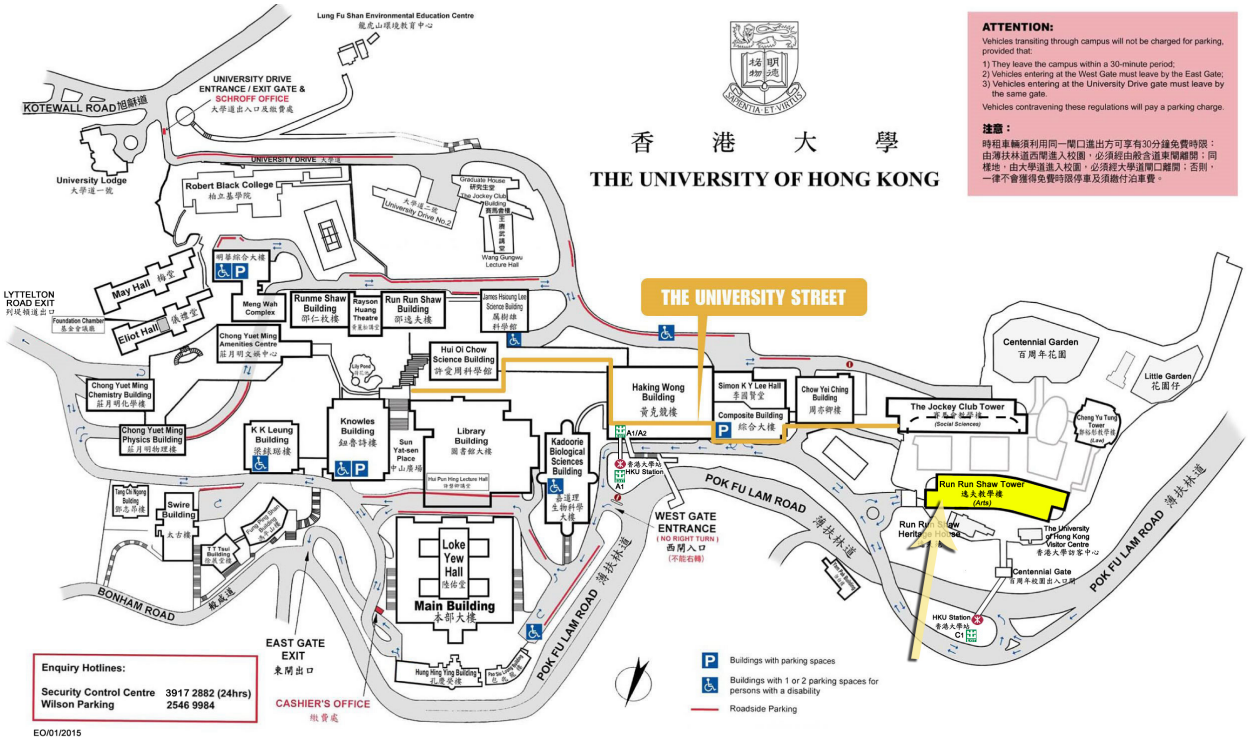
ENGINEERING Management

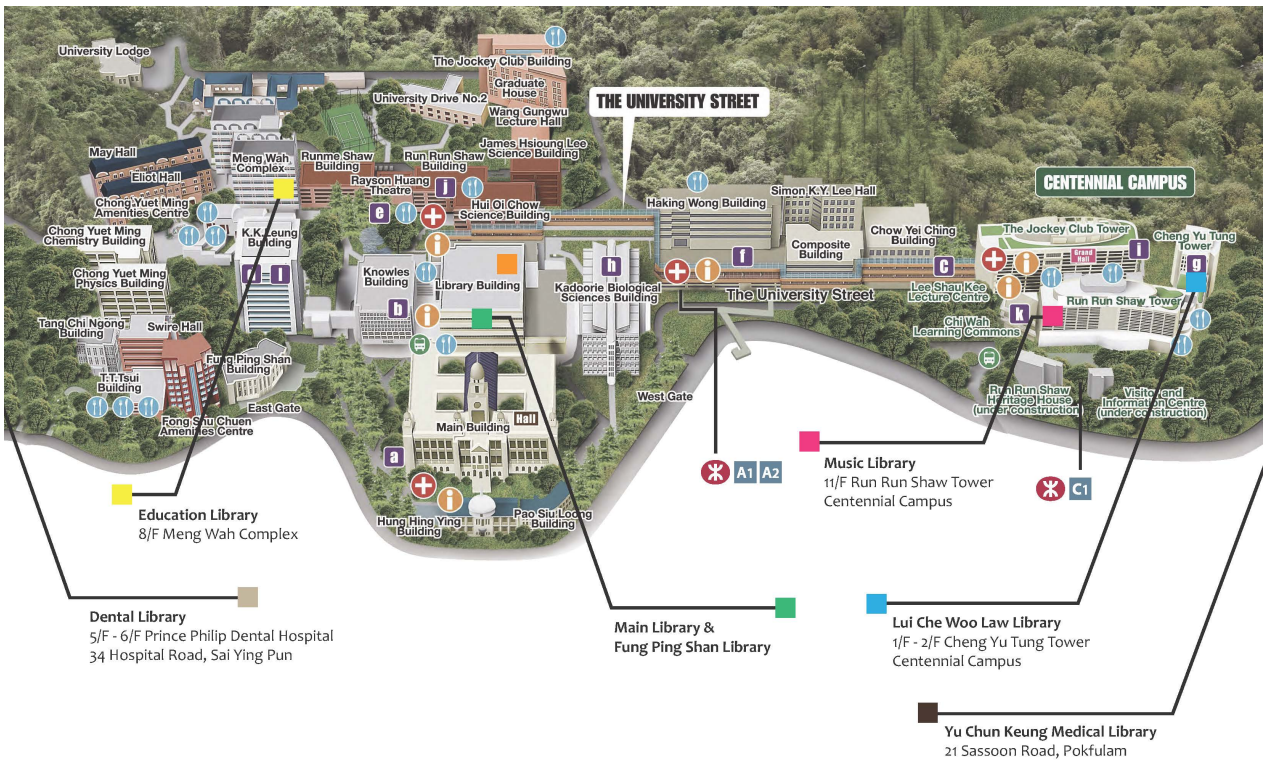
Hong Kong Society for Transportation Studies

2025 International Symposium on *Smart Mobility Systems*

Pre-Conference (HKSTS) Workshop

Location Map of the Workshop Venue.





香 港 大 學
THE UNIVERSITY OF HONG KONG

HKSTS 香港交通研究學會

ENGINEERING Management

Hong Kong Society for Transportation Studies

2025 International Symposium on *Smart Mobility Systems*
Pre-Conference (HKSTS) Workshop

Abstracts and Biographies of Speakers

Sensitivity of ITS Learning Models with Mobility Data
- applications in transportation privacy and cybersecurity

Xuegang (Jeff) Ban

As data is ubiquitous and data-driven models are widely deployed in intelligent transportation systems (ITS), issues related to data vulnerability, such as privacy and data security, are becoming more pressing in transportation. For this, understanding how sensitive ITS learning models are with respect to mobility data plays a central role. This talk focuses on the specific features of ITS learning models and proposes an analysis framework for studying and measuring the sensitivity of ITS models with mobility data. Related concepts, measures, theories, and computational tools are presented, which are tested using cybersecurity and privacy applications.

Dr. Xuegang (Jeff) Ban is the William and Marilyn Conner Endowed Professor with the Department of Civil and Environmental Engineering at the University of Washington. He received his B.S. and M.S. in Automotive Engineering from Tsinghua University, and his M.S. in Computer Sciences and Ph.D. in Civil Engineering (Transportation) from the University of Wisconsin at Madison. His research interests are in Transportation Network System Modeling and optimization, and Urban Traffic Modeling and Control. His recent work focuses on applying optimization, control, and ML/AI methods to the understanding and modeling of emerging technologies/systems in transportation such as Connected and Automated Vehicles, New Mobility Services, and electric vehicles/buses. Dr. Ban is an Associate Editor of Transportation Research Part C, IEEE Transactions on Intelligent Transportation Systems, and Journal of Intelligent Transportation Systems. He received the 2011 CAREER Award from the National Science Foundation (NSF), and the New Faculty Award from the Council of University Transportation Centers (CUTC) and the American Road & Transportation Builders Association (ARTBA) in 2012. He was also one of the recipients of the Finalist of Franz Edelman Award in 2017 by INFORMS.

香 港 大 學
THE UNIVERSITY OF HONG KONG

HKSTS 香港交通研究學會

ENGINEERING Management

Hong Kong Society for Transportation Studies

2025 International Symposium on *Smart Mobility Systems*
Pre-Conference (HKSTS) Workshop

Exact Methods through Decomposition: Insights from Logic-Based Benders Decomposition

Roberto Baldacci

Decomposition techniques for integer programs have played a central role in developing state-of-the-art exact methods for some of the most challenging optimization problems. Among these, branch-price-and-cut and Benders' decomposition are widely recognized as fundamental tools, instrumental in solving a broad spectrum of complex problems.

Benders' decomposition, introduced in 1962, is a powerful method whose key idea can be viewed as a form of logical inference. This insight motivates logic-based Benders decomposition (LBBD), in which the subproblem need not be linear but may be any optimization problem. LBBD generalizes the classical approach and has enabled a wide range of applications.

In this talk, we briefly review two primary types of decomposition: price (or constraint) decomposition and resource (or variable) decomposition. We then focus on variable decomposition and the LBBD framework, illustrating how it leverages problem structure to enhance computational efficiency and solution quality. The discussion also addresses practical aspects of implementation, including best practices and common pitfalls. Finally, we demonstrate the effectiveness of LBBD in solving challenging routing, scheduling, and packing problems, and conclude with key insights.

Dr. Baldacci is Professor of Operations Research at the College of Science and Engineering, Hamad Bin Khalifa University, Doha, Qatar. He holds a Ph.D. in Operations Research from Imperial College, University of London, United Kingdom. Previously, he was an Associate Professor of Operations Research at the College of Science and Engineering, Hamad Bin Khalifa University (2022–2025), Associate Professor of Operations Research at the University of Bologna, Italy (2012–2022), an Assistant Professor at the University of Bologna, Italy (2005–2012), an Assistant Professor at the University of Modena and Reggio Emilia, Italy (2001–2005), and a Postdoctoral Research Associate at the Centre for Quantitative Finance, Imperial College London, United Kingdom (2000–2001). His research lies at the intersection of Advanced Analytics, Operations Research, and Data-Driven Optimization, with a strong focus on transportation and logistics applications. It spans the theoretical development, design, implementation, and evaluation of algorithms for optimization problems. He specializes in both exact methods and heuristic or metaheuristic approaches. In recent years, his work has expanded to include stochastic and distributionally robust optimization, large-scale linear programming with column-dependent rows, and dynamic discretization discovery techniques. Dr. Baldacci has over 25 years of teaching experience across all levels (BSc, MSc, and PhD) and has supervised numerous undergraduate, graduate, and doctoral students. He serves on the editorial boards of INFORMS Operations Research and INFORMS Transportation Science. He has published over 100 papers in leading journals, including approximately 30 papers in the INFORMS Journal on Computing, Mathematical Programming, Operations Research, and Transportation Science.

香 港 大 學
THE UNIVERSITY OF HONG KONG

HKSTS 香港交通研究學會

ENGINEERING Management

Hong Kong Society for Transportation Studies

2025 International Symposium on *Smart Mobility Systems*
Pre-Conference (HKSTS) Workshop

Physics-informed data analytics - exploiting domain knowledge with hard data in a transportation network

Yueyue Fan

Civil infrastructure as a system often faces challenges brought by interactions between spatially- and functionally- distributed components. Recognizing and incorporating these physical interactions in data driven approaches present challenges but also unique research opportunities for domain experts. In this talk, I will use transportation networks as examples to discuss how constrained optimization, by providing a flexible modeling framework for integrating soft and hard information, could help address some fundamental challenges frequently arising in networked data. The first example shows how stochastic programming (SP) can be used to provide a statistically consistent and efficient estimate of global variables (network-level travel demand) based on partial local measurements (link-level traffic flows). The second example shows how stochastic optimization could be used to derive an effective information acquisition strategy for a dynamic traffic system to improve system identifiability. These examples highlight the importance of integrating domain expertise into the conceptual design, modeling, and numerical solutions of data-driven approaches for networked data.

Yueyue Fan is a professor in Civil and Environmental Engineering at University of California, Davis. Dr. Fan's research is on transportation and energy infrastructure systems modeling, with a special interest in integrating applied mathematics and engineering domain knowledge to address fundamental challenges brought by data and system uncertainty, dynamics, and underdetermined issues. Dr. Fan directed the Civil Infrastructure Systems (CIS) program during 2020-2023 and the Regional Innovation Engines program during 2023-2024 at the National Science Foundation of the United States.

香 港 大 學
THE UNIVERSITY OF HONG KONG

HKSTS 香港交通研究學會

ENGINEERING Management

Hong Kong Society for Transportation Studies

2025 International Symposium on *Smart Mobility Systems*
Pre-Conference (HKSTS) Workshop

From Self-Driving to Self-Organizing: Connected Vehicles as Catalysts for Smart Mobility

Lina Kattan

Advances in X2X connectivity promise a future where vehicles share information ubiquitously, enabling cooperative decision-making at scale. This keynote introduces a coalition game-theoretic framework for lane-changing among connected and autonomous vehicles (CAVs) in mixed autonomy traffic. Lane-change decisions are modelled as dynamic coalition formation processes, where vehicles negotiate via V2V communication, supported by a transfer utility incentive mechanism. This cooperation enables gap adjustment and equitable utility distribution, aligning microscopic maneuvers with macroscopic objectives such as shockwave damping, congestion reduction, and throughput improvement, and brings us closer to a self organising road network that is efficient, equitable and resilient.

Lina Kattan is a Professor of Transportation Engineering at the Schulich School of Engineering, University of Calgary. She holds the Canada Research Chair (Tier I) in Integrative Transportation Systems through Automation and Connectivity and the Urban Alliance Chair in Transportation Systems Optimization. She also directs the NSERC CREATE program in Integrated Infrastructure for Sustainable Cities, a pan-Canadian research initiative dedicated to systematic solutions for future cities and she co chairs the Schulich School of Engineering Momentum initiative on Engineering for a Sustainable Future. Her research spans traffic flow theory and control, connected and automated vehicles, network modelling and analysis, equity and fairness in transportation, emerging transportation technologies, and public transit operations and electrification.

Lina is a member of the College of Scholars, Artists and Scientists of the Royal Society of Canada and has received honours such as the Apega Summit Research Excellence Award, the ASTech Outstanding Achievement in Urban Development Research Award, the Killam Annual Professorship Award (NSERC category), and the NSERC Discovery Accelerator Supplement twice.

香 港 大 學
THE UNIVERSITY OF HONG KONG

HKSTS 香港交通研究學會

ENGINEERING Management

Hong Kong Society for Transportation Studies

2025 International Symposium on *Smart Mobility Systems*
Pre-Conference (HKSTS) Workshop

Disturbance Mitigation Strategies for Scheduled Mobility Systems

Fang He

Mitigating real-time disturbances in scheduled mobility systems is a critical challenge, particularly when the pre-determined sequence of events must be preserved for operational integrity. This study develops a general, sequence-preserving framework for this problem, representing complex system dynamics on a discrete event graph. We introduce a powerful online update framework that makes sequential, provably optimal decisions in a dynamic environment with a twofold uncertainty, where both exogenous disturbances and the system's own delay absorption capacities are revealed stochastically. We rigorously prove that the proposed strategy exhibits the maximum stabilization ability among all sequence-preserving approaches and propose an analytical method to assess long-term stability. The framework's versatility and effectiveness are validated through numerical experiments on two distinct systems: a futuristic connected and automated vehicle (CAV) network and a traditional urban metro network, demonstrating its applicability to both emerging and existing transportation paradigms.

Dr. Fang He is Deputy Head for Research and Tenured Associate Professor in the Department of Industrial Engineering at Tsinghua University. He serves as the Executive Vice Dean of the Tsinghua University–COSCO Shipping Green & Intelligent Supply Chain Institute. His research focuses on network modeling and optimization, large-scale combinatorial optimization and deep reinforcement learning, producing more than 60 journal papers, including publications in Transportation Science, Transportation Research Part Series, and Production and Operations Management. He serves as the Associate Editor of Transportation Science and the Editor of Transportation Research Part B. Dr. He is also a recipient of a national-level Young Talent Program in China, and his scholarly work has been implemented by China COSCO Shipping Group, AutoNavi Ride-Hailing, the Beijing 2022 Winter Olympics, and the Wuhan Power Grid, among other high-impact sectors. He has been recognized as an Elsevier Highly Cited Chinese Scholar for six consecutive years (2019–2024), with a single paper exceeding 600 citations. Dr. He received his B.S. degree in Civil Engineering from Tsinghua University in 2010 and his Ph.D. degree from the University of Florida in 2014.

香 港 大 學
THE UNIVERSITY OF HONG KONG

HKSTS 香港交通研究學會

ENGINEERING Management

Hong Kong Society for Transportation Studies

2025 International Symposium on *Smart Mobility Systems*
Pre-Conference (HKSTS) Workshop

Coordinated urban logistics: Combining public transit and drones for efficient distribution

Kai Wang

The surge in e-commerce has heightened the need for efficient last-mile delivery, prompting the exploration of drone-assisted logistics integrated with public transportation. This paper focuses on optimizing delivery costs in the Drone-Transit Coordinated Delivery Problem (DTCDP) by formulating mathematical models based on time-space networks. We use a multi-variable generation (MVG) algorithm that iteratively solves a sparse master problem and a subproblem to identify promising paths. For solving instances of varying scales, we developed a hybrid solution strategy: an exact algorithm combining a branch-and-bound framework with MVG, accelerated by cut generation and heuristic primal bounds, is applied to small and medium-sized cases; for large-scale cases, a heuristic method that solves a compact integer program after MVG pre-processing is employed. Large-scale experiments based on real-world data from Shenzhen demonstrate that our approach significantly outperforms benchmark methods, achieving speedups of up to 5x, alongside enhanced stability. Sensitivity analysis quantifies the effects of key parameters, including transit network scale, vehicle scheduling, drone charging rates and endurance, and network topology. The algorithm and model exhibit scalability, efficiency, and robustness, making them suitable for real-world urban logistics applications.

Kai Wang is currently an Associate Professor at the School of Vehicle and Mobility at Tsinghua University. He was a Research Scientist at Heinz College, Carnegie Mellon University (CMU) from August 2021 to June 2022, and a Postdoctoral Associate at Sloan School of Management, Massachusetts Institute of Technology (MIT) from August 2019 to July 2021. He obtained his Ph.D. degree at The Hong Kong Polytechnic University in 2019, supported by the Hong Kong Ph.D. Fellowship Scheme. Kai Wang's research spans large-scale, stochastic, and data-driven optimization, with primary applications in smart transportation and logistics systems. His research has tackled a wide range of real-world problems, spanning vehicle routing, shared mobility, urban logistics, urban aerial mobility, etc. His research has appeared in top-tier journals, including Operations Research, Management Science, Manufacturing & Service Operations Management, Transportation Science, and Transportation Research Part B, etc. It has been recognized with several academic distinctions, e.g., INFORMS 2023 Harvey Greenberg Research Award, INFORMS 2021 TSL (Transportation Science & Logistics) Society Best Paper Award,etc.

香 港 大 學
THE UNIVERSITY OF HONG KONG

HKSTS 香港交通研究學會

ENGINEERING Management

Hong Kong Society for Transportation Studies

2025 International Symposium on *Smart Mobility Systems*
Pre-Conference (HKSTS) Workshop

Joint Online Freight Allocation and Train Unit Scheduling with Reusable Resources for Emergency Logistics

Jiateng Yin

Efficient allocation of scarce transportation resources is essential for ensuring the timely delivery of life-critical freight such as organs and medical supplies. Motivated by emerging high-speed rail (HSR) freight operations, this paper studies a joint online freight allocation and train unit scheduling problem in which freight requests arrive sequentially over a finite horizon. Each request is classified as emergency or normal, reflecting its urgency and expected arrival characteristics. The decision-maker must dynamically assign available train units, that are treated as reusable resources that return to service after a fixed turnaround time, to maximize total social welfare and revenue.

We propose a linear-programming-based online algorithm that integrates an offline LP relaxation with a greedy allocation mechanism. By exploiting the submodular structure of the joint allocation space, we establish a theoretical link between reusable-resource scheduling and online allocation under heterogeneous priorities. We prove that our algorithm achieves a competitive ratio lower bounded by (1-1/e)1/4Δ, where Δ denotes the ratio between train unit capacity and the residual capacity after the heaviest shipment, approaching unity in practice. Computational experiments based on both real-world Beijing-Shanghai HSR data and synthetic instances demonstrate that the proposed algorithm attains near-optimal performance and significantly outperforms existing benchmarks. Beyond its methodological contributions, this study illustrates how optimization and online decision-making can directly enhance social welfare by enabling high-speed railways to support rapid, life-saving logistics services.

Jiateng Yin is a professor at the School of Systems Science, Beijing Jiaotong University. He received his B.S. and Ph.D. degrees from Beijing Jiaotong University in 2012 and 2018, respectively. He has also held visiting positions at the Institute for Transport Planning and Systems, ETH Zurich (2019), the Center for Transportation & Logistics, MIT (2024) and the Institute of Operations Research and Analytics, National University of Singapore (2024-2025). His research interests include transportation engineering, railway operations, and optimization, with over 50 publications in journals such as TR-B/C/E, JOC, EJOR, NRL and COR. He currently serves as a guest editor and editorial board member for Transportation Research Part C; he also served as cluster chair of INFORMS Railway Application Section. He received several awards, including the NSFC Funds for Young Sholars (B) and INFORMS RAS Best Paper Award (2023).