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Editorial

Editorial of the Special Issue on Novel Methodologies in Air Transportation

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Although the air industry has been affected by the recent coronavirus disease 2019 pandemic, it has shown rapid growth in economic development and evolving international trading worldwide. Such a trend is anticipated to resume post the pandemic, probably at a slightly slower pace. The growth of the air industry accelerated the movement of goods and people but also created challenges to air transportation systems, including operational inefficiency of airspace system, flight and passenger delays, divergent demands in aircraft manufacturing, and urgent needs for disruptive technologies to enhance the existing air transportation system. Such challenges attracted the interests of researchers worldwide. This special issue assembles novel methodologies in air transportation, the cutting-edge findings, and outcomes of researchers' efforts responding to these challenges. It fills the gaps in existing literature and offers solutions and directions on sustainable development of air transportation.

In response to operational inefficiency and associated problems, the US Federal Aviation Administration outlined its vision for NextGen in 2004 to encompass a wide range of improvements to communications, navigation, surveillance, and air traffic management (ATM) automation systems. Post provided an overview of recent developments of the plans, implementations, challenges, and future directions of NextGen. Artificial intelligence and machine learning hold substantial promise for further improving the safety, efficiency, environmental impact, and cost effectiveness of ATM. The Single European Sky ATM Research (SESAR) project is the technological pillar of the European Commission's Single European Sky Initiative to modernize the ATM. Bolic and Ravenhill described the process of establishing SESAR, the research and development (R&D) component led by SESAR Joint Undertaking, the deployment managed by SESAR Deployment Manager, and the European ATM Master Plan that collects and lays out both the R&D and deployment needs. One important takeaway point from their summary is that significant research into regulatory issues is required.

Aircraft manufacturing industry serves as a powerful engine for national economic growth. The development of large passenger aircraft is of great strategic importance for China. Wu introduced the manufacturing of commercial aircraft in China and provided a macro perspective of development of modern commercial aircraft of China. The aeronautical communication system (ACS) is also a core infrastructure of the air transportation system that ensures safety and a high level of efficiency. According to the consensus of the global aviation community, promoting the development of the ACS from narrowband to broadband has become an inevitable choice for modern ACS construction. Zhang identified key barriers in the development of an aeronautical broadband communication (ABC) system while considering the unique features involved, proposes promising technical strategies, and puts forward the concept of a new-generation ABC system based on the idea of a space–air–ground integrated network.

Flight delays lead to economic loss of both airlines and passengers and severe flight delays reduce the competitiveness of air transportation compared to other substitutable ground modes. Flight delays occurring in one part of the air transportation network can propagate to other parts of the network. Zhang et al. applied a latent class model to study the flight delay propagation and demonstrated the effectiveness of this framework on a large-scale air transportation network. Their study outcomes help airport operators and airlines better understand air traffic and delay patterns according to the experience gained from historical scenarios. Cai et al. modeled air traffic scenarios with spatial-temporal networks and acquired a comprehensive understanding on delay propagation dynamics in terms of its magnitude, severity, and

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speed. In addition to understanding the patterns and dynamics of delay propagation, airline operation centers need to perform various disruption management measures to rearrange resources (e.g., flights, aircraft, and crews) and reassign passengers to restore the schedule while minimizing flight delay and disruption costs. A comprehensive review of airline disruption management was provided by Su et al. in this special issue. The authors reviewed the models of aircraft and crew recovery in disruption management as well as integrated recovery considering passengers. Details of the models provide the characteristics and applications of recovery options that help airlines to choose appropriate methods to meet their specific business interests.

The development of emerging technologies has brought many possibilities for future transportation system. Urban air mobility (UAM) is an emerging concept proposed in recent years that uses electric vertical take-off and landing vehicles to transport passengers in low-altitude urban airspace. The concept can be expanded to regional travel and rural airspace as well. Wu and Zhang modified hub-spoke network modeling and developed efficient solution algorithm to determine vertiport locations and estimate diverted demand from existing ground transportation modes to emerging UAM service. Their study offered in-depth planning and managerial insights for municipal decision-makers and UAM operators.

In the air traffic control area, Wang et al. investigated air traffic controllers' eye-movement. They identified that working experience has a notable effect on controllers' eye-movement behavior, which provides insights that can lead to a better understanding of cognitive strategies and decision-making in the ATM system. Faced with airport airside operations, Obajemu et al. propose a novel approach for generating efficient four-dimensional trajectories based on a high-fidelity aircraft model and gain-scheduling control strategy.

On behalf of the Editorial Board of this special issue, we are thankful for the contributions of the authors and the effort and professionalism of reviewers. Sincere appreciation is also given to all members on the Editorial Board who devoted time and effort toward the completion of this special issue. We welcome comments and feedback of readers and suggestions on future special issue topics.