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Editorial

Challenges and Opportunities of Maritime Transport in the Post-Epidemic Era

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The global outbreak of COVID-19 has cast a protracted shadow over the international economic landscape, with maritime transport emerging as a cornerstone of resilience and adaptation. As the world grapples with the aftermath of the COVID-19 pandemic, the maritime sector has stood at the forefront of efforts to maintain global supply chains, facilitate trade, and stimulate economic recovery, with maritime transportation becoming a vital lifeline. However, this period of unprecedented turmoil has also exposed the inherent vulnerabilities and inefficiencies of traditional maritime operations. As the backbone of global supply chains, this crisis has revealed opportunities for technological innovation and strategic adjustments, positioning the maritime transport industry at the cusp of significant challenges and transformations. In the post-pandemic era, maritime transport faces a series of intricate issues. On one hand, the industry has had to contend with logistical bottlenecks such as port congestion, supply chain disruptions, and operational inefficiencies, all of which have significantly impacted shipping schedules and escalated costs. On the other hand, it must swiftly adapt to new health and safety protocols, technological advancements, and shifts in consumer behavior that are reshaping the global trade landscape. Amidst these challenges, maritime transport has also demonstrated remarkable resilience, with industry participants leveraging innovation and collaboration to mitigate risks and capitalize on emerging opportunities.

This Special Issue, titled “Challenges and Opportunities for Maritime Transport in the post-COVID-19 Era”, includes three high-quality research papers, covering research on multiple underwater vehicles, port congestion, and efficient terminal operations, to explore the challenges and opportunities for maritime transport in the post-COVID-19 era, especially in engineering. Next, we will review the research content of these papers according to different topics.

The first topic is multiple underwater vehicles. In particular, An et al. [1] focused on the fixed-time leader-follower formation control of multiple underwater vehicles (MUVs) under external disturbances. Given the practical working conditions, the communication equipment of underwater vehicles often faces constraints. Therefore, for MUVs under unknown time-varying external disturbances in a directed network, they proposed a distributed event-triggered fixed-time leader–follower formation trajectory tracking control methodology based on AFxDO. Meanwhile, to tackle the inherent "explosion of complexity" issue in traditional backstepping, a nonlinear first-order filter was designed. Furthermore, by incorporating an event-triggered mechanism, bandwidth resources are conserved, and the communication burdens are alleviated.

The second theme is port congestion in the post-pandemic era, including network disruptions and their knock-on effects on global transportation systems. Guo et al. [2] initially introduced an innovative algorithm for processing a specific queuing model and obtained analytical insights into the response of ports of different sizes to the same degree of disruption, as well as the performance of herding behavior within the transport system. The

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study found that (1) disruptions at smaller ports lead to longer round-trip time compared to larger ports; (2) herding behavior in the transportation system leads to more congestion and more emissions; and (3) major-rare disruptions result in a longer waiting time at the disrupted ports and other ports of call in the transport system.

The third theme is terminal operations. Severe congestion at terminals during the COVID-19 pandemic has prompted managers to prioritize a dynamic distribution strategy for the terminal operating system in the post-pandemic era. Wang et al. [3] developed a dynamic stack-based model of yard space allocation that takes into account the effects of shipping schedule fluctuations, with the primary goal of minimizing truck movement and achieving a balanced block distribution. The results show that due to the expansion of bay space and the change in operation process, the allocation of automated terminal yard space is more suitable for the stack-based processing mode. In the stacking mode, the automated rail-mounted gantries has a higher operating efficiency, which can help terminals achieve a better dynamic distribution balance with lower energy consumption.

In summary, this research topic illustrates that the post-pandemic era has brought not only severe challenges but also unprecedented opportunities to the maritime sector. As the world deals with the aftermath of the pandemic, the innovation and collaboration demonstrated in these three articles pave the way for the future development of the maritime transportation industry. By addressing the complexity of underwater operations, mitigating the impact of port congestion, and optimizing terminal operations, maritime transportation systems can become stronger, more efficient, and better able to meet the needs of a globalized and connected world. The insights and approaches presented in this Special Issue set the stage for continued exploration and innovation, ensuring that the maritime industry remains a vital part of the global economy.

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