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EDITORIAL

Preface to special issue on advances in research of railway train brakes

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Brakes in railway trains have a variety of forms such as air brake, eddy current brake and aerodynamic brake. Their primary functions are to slow down and stop trains, so as to ensure safe and efficient train movement. Brakes are indispensable and safety-critical systems for all types of railway trains including passenger (high-speed, metro, tram, etc.) and freight (heavy-haul, intermodal, etc.) trains. Safe and efficient railway operations require a good understanding of brakes from various parties including drivers, maintenance crews, manufacturers, and design engineers. Research helps to expand and deepen the knowledge about railway train brakes. Brake modelling and simulation date back to the pre-digital age. However, it remains a challenging topic to today due to many reasons including their nonlinear dynamic nature, complex devices, and the limits regarding parameter determination.

Brake models have mainly been used for train dynamics simulations and brake performance predictions. Brake monitoring is also a developing topic and has been a part of train health monitoring systems. The emerging smart autonomous railway systems have now increased the requirements for these topics. For example, autonomous trains, communication based train control, and railway train virtual coupling require even higher accuracy in predictions and monitoring of air brake systems. In the meantime, innovative brake designs are continually pursued.

Driven by the rapid development of intelligent transport systems and the ever-increasing demands for faster and heavier trains, as well as energy savings and sustainability, railway brake research has seen a new wave of interest from the industry and academia.

This special issue brings together a group of renowned experts in the field of railway brake research from around the world, offering a comprehensive collection of the latest developments and trends in the industry. After multiple rounds of peer reviews and editor deliberations, seven high-quality papers are selected for the special issue. The topics covered include train braking dynamics, brake distance prediction for intelligent transport systems, fast brake simulation models, brake system testing, and new fluid dynamic air brake models.

The editors extend their deep appreciation to all contributors for this special issue and hope that the documented new knowledge will inspire further research in the field of railway brake research.

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