SPECIAL ISSUE ON WORK OF THE COOPERATIVE RESEARCH CENTRE FOR RAIL INNOVATION, AUSTRALIA

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Guest Editorial

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The Cooperative Research Centre (CRC) for Rail Innovation (www.railcrc.net.au) is the largest rail research program in the history of Australasian railways, with over $100m in resources being applied to the rail industry over seven years. It is a unique and productive initiative which links industry participants from Australia and overseas with the research and development expertise of seven of Australia's leading universities. It has sponsored ground-breaking research into the rail industry and has supported high-level collaborative research projects to address research themes such as Performance, Safety and Security, Smart Technologies, Urban Rail Access, Climate Change and the Environment, and Workforce Development. It involves an interdisciplinary approach which recognises that the operation of railways involves, in addition to engineering and technical considerations, a variety of human factor issues, for example, safety awareness, planning, and training.

The research program has been aimed at making transformational changes across the rail industry, both in Australia and elsewhere in the world. Research projects have produced tangible outputs for use by the rail industry. Areas with technical and engineering applications such as wheel steels, ballast, and noise reduction have formed an important part of the CRC's research program. Other areas include: algorithms that form vital links in new and existing software; a guide to human factors in the workplace; career pathways, skills recognition, mentoring and coaching websites; and training courses that will improve the professional development of rail industry professionals.

The CRC has also had a major impact on education and training for the rail industry. A large number of postgraduate research scholarships have been awarded by the CRC, thereby enhancing the Australian industry skill base. Similarly, a number of postdoctoral fellows have been involved, providing high-level research expertise in key projects aimed at making a difference.

There is an ongoing worldwide revival in railways with the emphasis on high speed rail, light rail, heavy haul, and state-of-the-art technological developments. Rail in Australia is a large and vibrant sector that underpins the nation's wellbeing and prosperity. Nevertheless, there are some significant challenges to be addressed including: improving efficiency, productivity and safety through industry collaboration; working with all stakeholders to reduce level crossing collisions; ensuring rail's contribution to the economy and society are maximised through strategic policy; and ensuring sufficient supply through defining emerging skills and technology needs.

This special issue published in *Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit* showcases areas of current research in rail in Australia and focuses on the application of research to the rail industry in order to address some of the challenges outlined above. The topics included in this issue were chosen by stakeholders and the research has been industry-driven. Many of these issues involve interdisciplinary

considerations, and this overlap is reflected in the papers. The papers contained in this publication provide a snapshot of the innovative research supported by the CRC for Rail Innovation, and include contributions by Australian researchers, postdoctoral fellows, and post-graduate research students.

The special issue begins with a focus on the role of simulation with Naweed looking at the lack of effective integration of simulators into driver learning frameworks, despite their increasing uptake, and proposing ways of addressing systemic and cultural impediments. The correspondence between simulation and the real world is further explored by Naweed and Balakrishnan who present a fidelity evaluation applied to a railway research simulator. The outcomes of this research provide important messages regarding simulators post-deployment. Kim et al. demonstrate the value of driving simulators and traffic simulation in assessing safety devices at railway crossings.

Computer simulation software is used by Sun et al. to examine energy usage and energy from dynamic braking, and they consider ways of optimising power for heavy haul trains, which form a major part of the Australian rail industry. Spiryagin et al. work within the context of the current debate in Australia on standards by proposing a Locomotive Model Acceptance Procedure to validate multibody models of locomotives intended for use on Australian railways; this uses a virtual model to test dynamic behaviour.

Three papers address areas of major concern in the Australian rail industry at the present time – noise and track condition. Liu and Meehan look at wheel squeal in the context of angle of attack and rolling speed, and develop a new method for measuring contact forces in rolling contact. The paper by Daniel et al. on rail squats contributes to further understanding regarding the nature of the formation of track defects and their measurement. Ahmad et al. present a simple track stability management tool based on rail stress and track resistance in order to enhance track safety. The tool was developed following an investigation of track buckling.

Safety issues are a major focus in Australia, as well as in many other parts of the world. The paper by Noorudheen et al. considers new technologies for track worker safety and examines the impact of human factors for the effectiveness of the technologies. Human factors, this time in relation to control room technologies, are also examined by Crawford et al. who highlight the need for collaboration between railway operators, systems engineers and ergonomists for better control room systems.

Nallaivarothayan et al. describe exciting work in detecting anomalous events at rail level crossings through their development of new algorithms to detect abnormal activities in these locations. This work will be of great benefit to those involved in preventing accidents and incidents around railways. Safety at level crossings is addressed in two papers by Wullems and others. These deal with: the limitations of current data regarding near-misses and how to improve safety data collection and analysis; and developing a risk model for low-cost safety devices at level crossings.

Costs associated with ageing railway bridges are examined by Nielsen et al. in the context of a practical framework for the life cycle management of Australian concrete and steel railway bridges. This involves bridge assessment, and maintenance optimisation and implementation, leading to more informed decision-making about managing bridge assets. The final paper by Albrecht et al. is concerned with developing a robust but simple system to reduce the total cost of lateness for long haul train plans which can be built into the train planning work flow.

We believe the papers in this special issue make a valuable contribution to current challenges facing the rail industry in Australia and have global applicability. In concluding, we would like to thank the authors for their timely contributions to this special issue and to the expert reviewers around the world who have provided invaluable input to the development of the papers. We also wish to especially thank Simon Iwnicki, Anita Treso and Maureen Bella for their untiring efforts in bringing this publication together.

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