

An Indian-Australian research partnership

Project Title: The Investigation of Damage evolution under rail/wheel contact

Project Number IMURA0786

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Research Clusters:

Research Themes:

Highlight which of the Academy's CLUSTERS this project will address? <i>(Please nominate JUST <u>one</u>. For more information, see www.iitbmonash.org)</i>		Highlight which of the Academy's Theme(s) this project will address? <i>(Feel free to nominate more than one. For more information, see www.iitbmonash.org)</i>	
1	Material Science/Engineering (including Nano, Metallurgy)	1	Advanced computational engineering, simulation and manufacture
2	Energy, Green Chem, Chemistry, Catalysis, Reaction Eng	2	Infrastructure Engineering
3	Math, CFD, Modelling, Manufacturing	3	Clean Energy
4	CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control	4	Water
5	Earth Sciences and Civil Engineering (Geo, Water, Climate)	5	Nanotechnology
6	Bio, Stem Cells, Bio Chem, Pharma, Food	6	Biotechnology and Stem Cell Research
7	Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng	7	Humanities and social sciences
8	HSS, Design, Management	8	Design

The research problem

The rail/wheel contact conditions are determined by the relationship of traction and creep at the rail/wheel interface. In the contact patch, the relative proportions of stick and slip regions are continuously changing as the traction force increases. The pure sliding state will be reached when the adhesion limit is achieved. Under sliding conditions, significant amounts of heat can be generated very quickly due to the associated friction conditions. The combination of this thermal loading and that from normal wheel-rail contact may contribute the development of some types of surface damage, for example "squats" in rails. This is particularly true for the contact between driven wheelsets in locomotives or motorised EMUs, and rails. A detailed understanding of damage modes and material characteristics of rails under these non-steady-state (transient) rail/wheel contact conditions is required to provide better guidance to rail/wheel interface management procedures.

Project aims

Define the aims of the project

- 1) Investigate (modelling) the contact stresses developed in rails under various kinds of wheel-rail interaction scenarios.
- 2) Carry out experiments using twin-disc machine to study transient rail/wheel contact conditions.
- 3) Study of the sub-surface microstructural evolution of the rail and wheel.
- 4) Detailed investigation of damage modes under transient rail/wheel contact conditions.
- 5) Recommendations to the strategies for mitigating the damage.

Expected outcomes

Highlight the expected outcomes of the project

1. Understanding of reasons for rail surface damage due to non-steady-state rail/wheel contact conditions
2. Development of better guidance to rail/wheel interface management procedures.

How will the project address the Goals of the above Themes?

By understanding the root cause of formation of defects in rails under transient rail/wheel contact conditions, changes can be made in rail manufacturing and maintenance strategies for more robust railway operations.

Capabilities and Degrees Required

1. BTech/MTech: Metallurgy/Materials Science/Mechanical Engineering.
2. Hard working
3. Should have excellent analytical and experimental skills.
4. Willingness to do systematic experiments and modelling.
5. Willingness to make field trips to understand railways better.

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

Select up to **(4)** keywords from the Academy's approved keyword list (**available at <http://www.iitbmonash.org/becoming-a-research-supervisor/>**) relating to this project to make it easier for the students to apply.

Rail/wheel contact, metallurgy, modelling, mechanical engineering