Faculty of Engineering
Summer Research Program 2022-2023

Project Title: Effect of uncertainty of contact location on rolling contact fatigue crack growth in railway rails

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Objective
Investigate the effect of the uncertainty of contact location on rolling contact fatigue crack growth in railway rails.

Project Details
Rail transport plays a pivotal role in economy through the freight transport of products and the passenger transport of metropolitan commuters and visitors. Under cyclic loading from the wheel and rail contact, rails will degrade in the forms of wear and rolling contact fatigue. Fig. 1 shows an example of rolling contact fatigue cracks at the surface of a rail head. Rolling contact fatigue cracks can eventually develop into transverse cracks, as shown in Fig. 2, which would lead to catastrophic rail breaks and increase the risk of derailments.
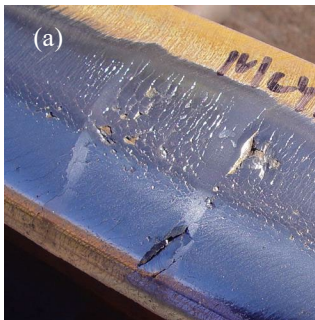
Researches have been conducted on the characteristics of rolling contact fatigue cracks, such as crack tip stress intensity factors, under given loading conditions as well as fixed contact locations. Practically, the contact locations vary due to many factors. There is a lack of study on how the uncertainty of contact location affects rolling contact fatigue crack growth. This summer project will focus on this research question, which will include three basic tasks:

1. Literature reading to understand background information and relevant researches.
2. Applying developed finite element models to calculate stress intensity factors of rolling contact fatigue cracks due to different contact locations.
3. Applying proper statistic tools including machine learning methods to analyse the numerical results.

Prerequisites
The student should have a good knowledge of solid mechanics, be interested in math and computational simulation and have the experience with the finite element method.