MONASH
ENGINEERING

MONASH University

Faculty of Engineering
Summer Research Program 2022-2023

Project Title: Effect of wind on catenary-pantograph systems in electric railways

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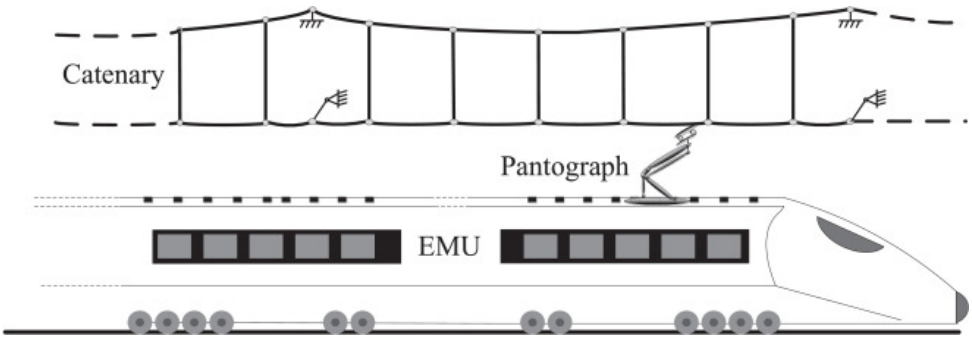
Objective

Development of a wind and catenary-pantograph interaction finite element model and examining the effect of the wind with changing speed and direction

Project Details

In modern electric railways, the overhead contact line, also known as catenary, is one of the most used systems. This railway catenary is a structure made of a complex system of cables that provides the electrical energy to the train by means of the contact between the pantograph, located on the roof of the drive unit of the vehicle, and the catenary itself, as illustrated in Fig.1.



The current collection quality is mainly determined by the contact situation between the pantograph strip and the catenary. Too high contact forces can cause excessive wear of both catenary and the pantograph strip. While too low contact forces can lead to loss of contact and electrical arcing. Besides other designable factors, strong wind in a bad weather will also affect the contact forces between the catenary and the pantograph during the operation of an electrified train. This summer project aims to develop a finite element model to consider the interaction between a strong wind and a pantograph-catenary system. After the verification of the established finite element model, the variation of the wind speed and direction will be further examined. The outcomes from the summer project will assist the design and maintenance of pantograph-catenary systems in electric railways. To work on the project, three basic tasks will be involved:

1. Literature reading to understand background information and relevant researches.
2. Applying a finite element model considering the wind and a pantograph-catenary system interaction based on an existing pantograph-catenary model.

3. Simulating the wind and pantograph-catenary interactions under different wind speed and direction and analyzing the simulated data.

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.