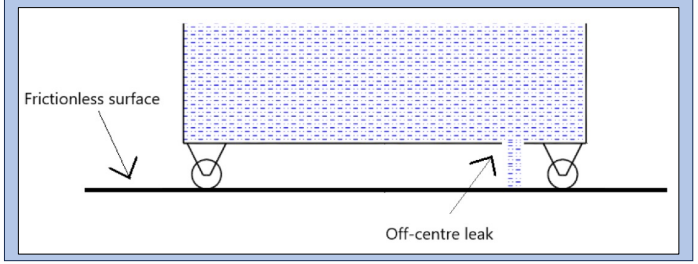
The Leaky Tank Mystery

THE UNIVERSITY of ADELAIDE

1. BACKGROUND & MOTIVATION

- The leaky tank mystery is an elusive mystery that has spanned across many decades and yet has never been experimentally solved.
- It explores the motion of a rail car with an **off-centre leak** among a **frictionless surface**.
- Despite the seemingly simplistic nature of this problem, definitive results are yet to be substantiated.
- Solving this problem will help develop our understanding of fundamental physics concepts.



2. AIM

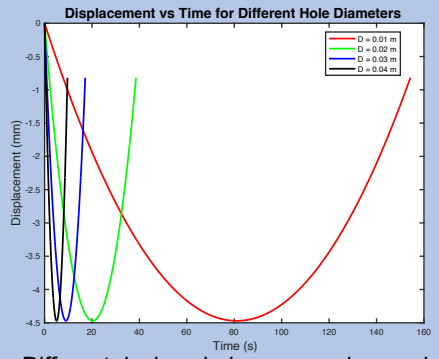
- Accurately **determine the motion and behaviour** of the leaky tank car through theoretical and experimental methods.

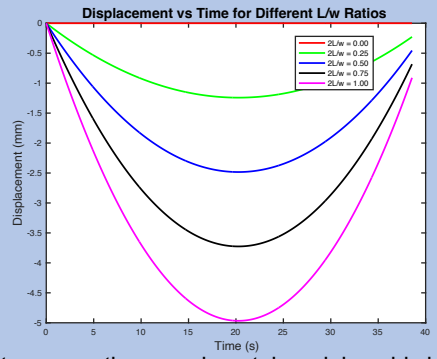
3. OBJECTIVES

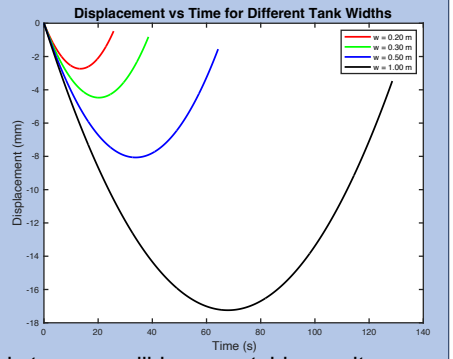
- Create **simulation models** using COMSOL and ANSYS to yield expected results.
- Design an **experimental model** to use in physical testing methods.

4. PARAMETER ANALYSIS & DESIGN CHOICES

- Several design parameters affect the behaviour of the tank. These include the **size of the hole**, **position of the hole**, **width of the tank**, **height of the water level**, **dry mass of the tank**, and **turbulence of water flow**.



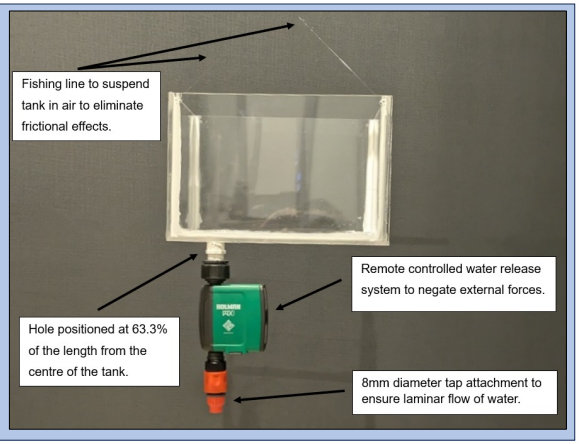




- Different design choices were also made to ensure the experimental model could yield strong, credible, repeatable results.
- This includes implementation of a **remote-controlled water release system** to prevent external forces to the tank.
- Additionally, the tank was designed to be **suspended in the air** to negate the effects of friction.

5. OUTCOMES

- **Hole position** has the greatest effect on tank movement, it ranges from no displacement at the centre, to maximum displacement at either end of the tank.
- **Width** of the tank also has a significant effect, where a larger tank results in greater displacement.
- A **greater amount of water** in the tank will produce a **greater force**, although a larger tank of water is required and would be **impractical**.
- The behaviour of the tank is **extremely difficult** to display physically primarily due to **friction**.



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