

## **Simulation of a Rotational Brake System Regulated by Change in Angular Deceleration**

**A fully mechanical rotational brake system is analysed using simulations in the multibody dynamics software Adams. Avoiding entanglement of fishing lines is only one of its many viable applications.**

Currently, several brake systems are used at the same time in fishing rods. They do not sufficiently prevent entanglement of fishing lines. Inefficient brake systems are found in several other fields, not only in fishing rods. Some of those systems are activated at certain angular velocities or controlled by electronics. The observed brake system is instead fully mechanical and activated due to change in angular deceleration. It will therefore activate earlier and provide a better, more efficient solution.

For comparison, imagine riding a car. Suddenly it brakes harshly. You and everything in the car are thrust forward! Similarly, the pendulum in the brake system swings out due to a body's tendency to resist changes in motion. Contact between the brake pad and drum is then established and a braking motion starts. If a pulling force occurs, imagine pressing down on the gas pedal, the brake system is deactivated.

The main objective of the thesis is expanding the field of usage and finding more applications. Multibody dynamics simulations are made in order to avoid the cost of building and testing different prototypes. With the simulations, several types of dependencies are investigated. Examples of which include the weight of the pendulum and the friction on the brake material. These are also done to further explore the theory behind three different models of the brake system.

It was found in the results that if the rotational velocity is too low, the brake system is activated. Mass distribution of the pendulum was found to influence when this activation happens. At the same time, too small decelerations will not activate the brake system. The friction coefficients at the contact point between brake pad and drum are the major factors regarding the speed of the braking. The coefficients are material dependent. Lower values, but not too low, are found to be optimal. These take longer to brake but lead to smoother behaviour, which is desirable in most cases.

One of the three models has a spring implemented. Depending on the spring stiffness, smoother brake sequences are obtained. A trade-off between keeping the pendulum activated and slowing down steadily is noted. The optimal spring stiffness values are found to be system dependent. Furthermore, the effect of non-linear springs is examined. A distinct difference between linear and non-linear springs is found when observing the behaviour of the system during brake sequences. None of the results were found to disprove the theory and sequence of events assumed beforehand.

This project is the first time any comparable research or simulations have been made on this brake system. Validation of our results is difficult as there is very little available for comparison. Testing with real prototypes is needed to make sure they are correct. The brake system is examined from a general perspective. Finding specific applications for it is the next step. When creating and optimising models for such applications, our results can be used.