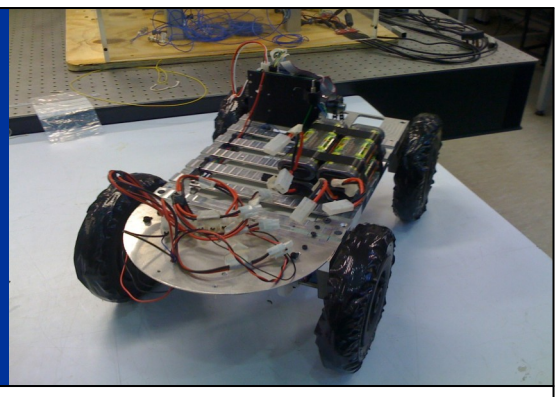
Investigation into traction control and slip analysis of a longitudinal speed controlled car



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Slip occurs when a wheel velocity is not equal to the vehicle velocity and so the wheel will slide on the ground. This can occur in the longitudinal and lateral directions such as in accelerating, braking and cornering.

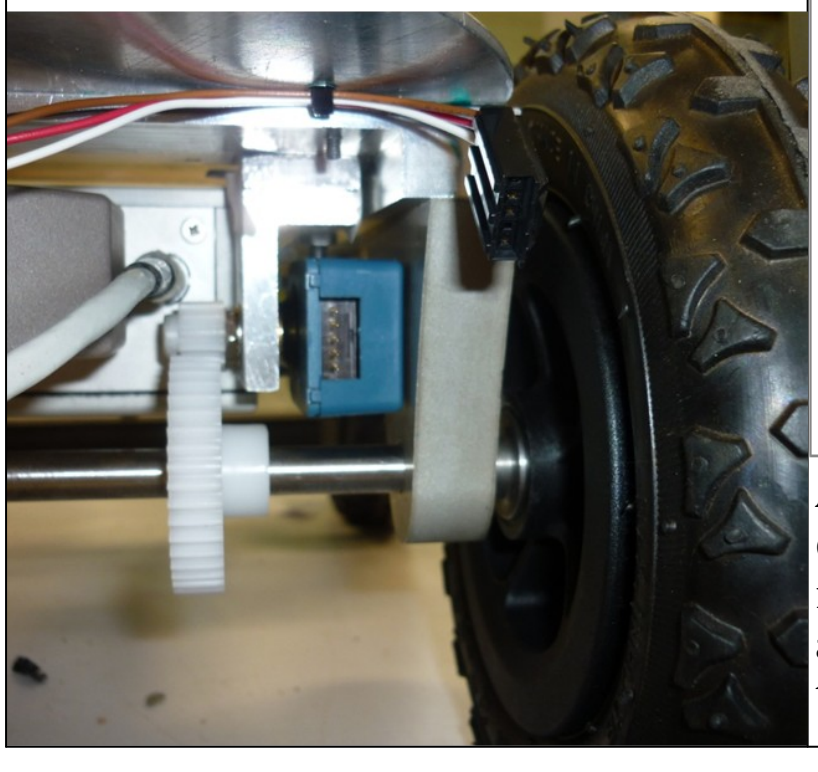
The amount of slip with forced rear wheels and free front wheels is defined as:

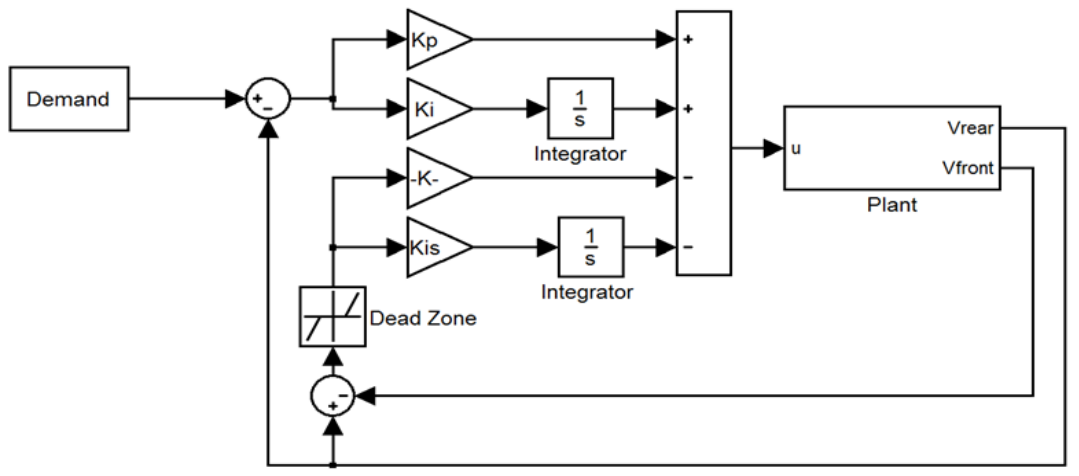
$$\frac{Vrear - Vfront}{Vrear}$$ (Acceleration)

$$\frac{Vrear - Vfront}{Vfront}$$ (Braking)

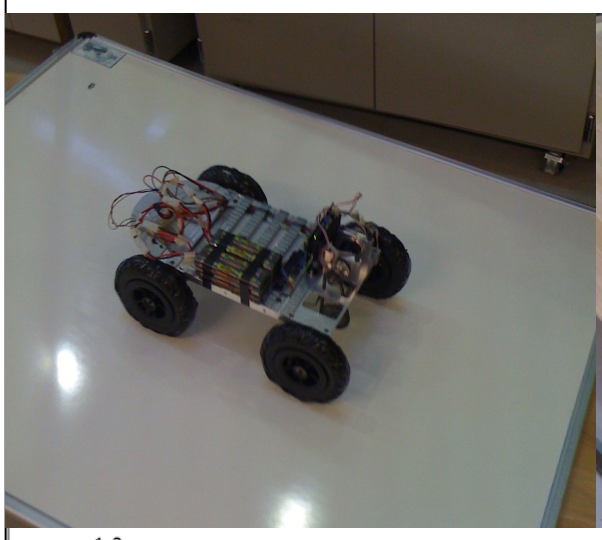
A number of systems have been developed to help counteract this is in modern vehicles. These include ABS, TCS and ESC amongst more complex systems. Their aim is to increase driver safety by reducing excessive slip on the tyres which causes increased braking times, increased tyre wear and reduced control for the driver.

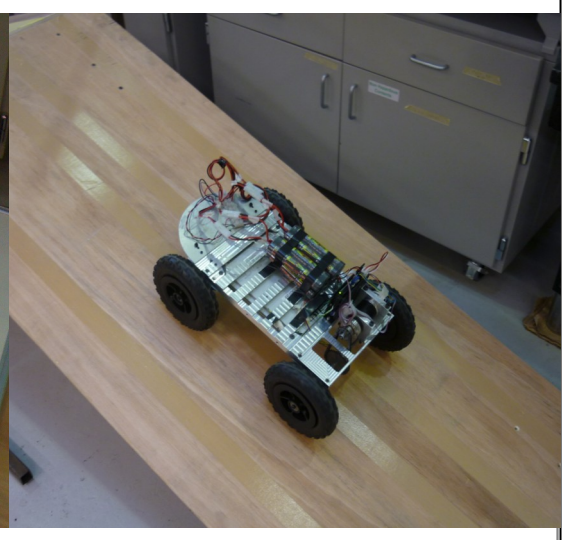
The aim of this project was to firstly assemble and implement an encoder to receive front wheel speeds from a previously built vehicle, and then secondly to develop a controller that would maximise the amount of traction the vehicle experienced.

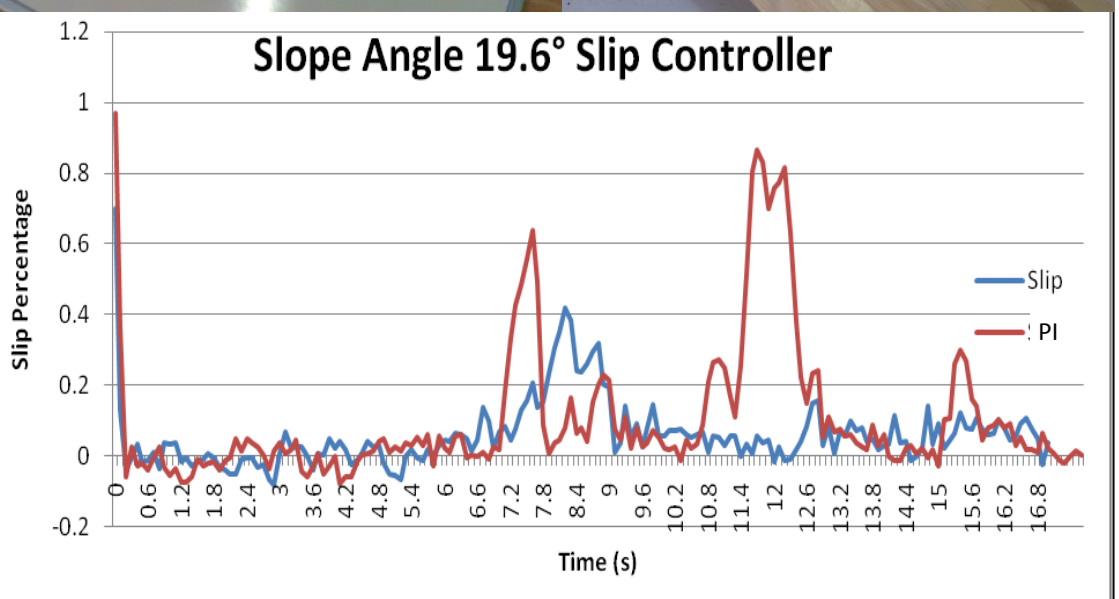




A controller that ignored slip was then built in Simulink and then compiled in dSpace utilising a MicroAutoBox that could also record data to be analysed on the controller's performance. The controller was then tested on increasingly higher gradients and different surfaces. This was then compared with a controller that utilised the amount of slip to maximise the vehicle speed, that can be seen above.







A number of approaches were considered to optimise the slip controller and from the results there is a large improvement in the amount of slip and vehicle speeds. The slip controller also allows the vehicle to climb slopes of higher gradient than the controller that ignored slip.