ANTI-LOCK BREAKING SYSTEM IN SIMULINK

INTRODUCTION:

Anti-Lock Breaking System is an automobile safety system that allows the wheels on a motor vehicle tomaintain tractive contact with the road surface according to driver inputs while braking, preventing the wheels from locking up and avoiding uncontrolled skidding. ABS modulates the brakeline pressure independent of the pedalforce, to bring the wheel speed back to the slip level range that is necessary for optimal braking performance.

MATHEMATICAL MODEL:

Wheelslip:

When the braking action is initiated, a slippage between the tire and the contacted road surface will occur, which make the speed of the vehicle to be different from that of the tire. Wheel Slip is considered as **0.2**

$$Relative\ Slip = 1 - \frac{Vehicle\ Angular\ Velocity}{Wheel\ Angular\ Velocity}$$

Angular Acceleration:

Equivalent Vehicle

Angular acceleration $= -\frac{Tyre\ Torque}{Vehicle\ Mass\ x\ Wheel\ Radius}$ (negative sign for deceleration)

Angular Velocity:

Equivalent Vehicle

Angular velocity = Integral of equivalent angular acceleration

Since F = ma, T = Fr = ma * r, a = T/(m*r), $v = \int a\ dt$

Tyre Torque:

Tyre Torque = μNR

μ – Co-efficient of friction

N – Normal Force per wheel $= \frac{mg}{4}$

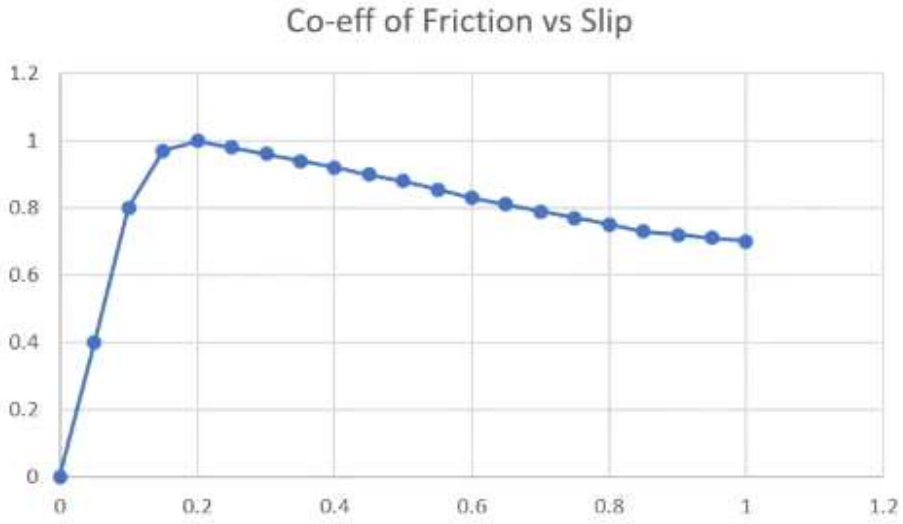
m = mass of the vehicle

R – Wheel Radius

SIMULINK MODEL:

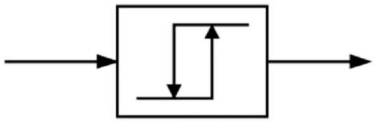
1-D Lookup Table:

A 1-D lookup table was used to initialize the values of coefficient of friction and slip in the model.



Bang-Bang controller:

- Outputs 1 if the input is greater than 0
- Outputs -1 if the input is less than 0



Data Dictionary:

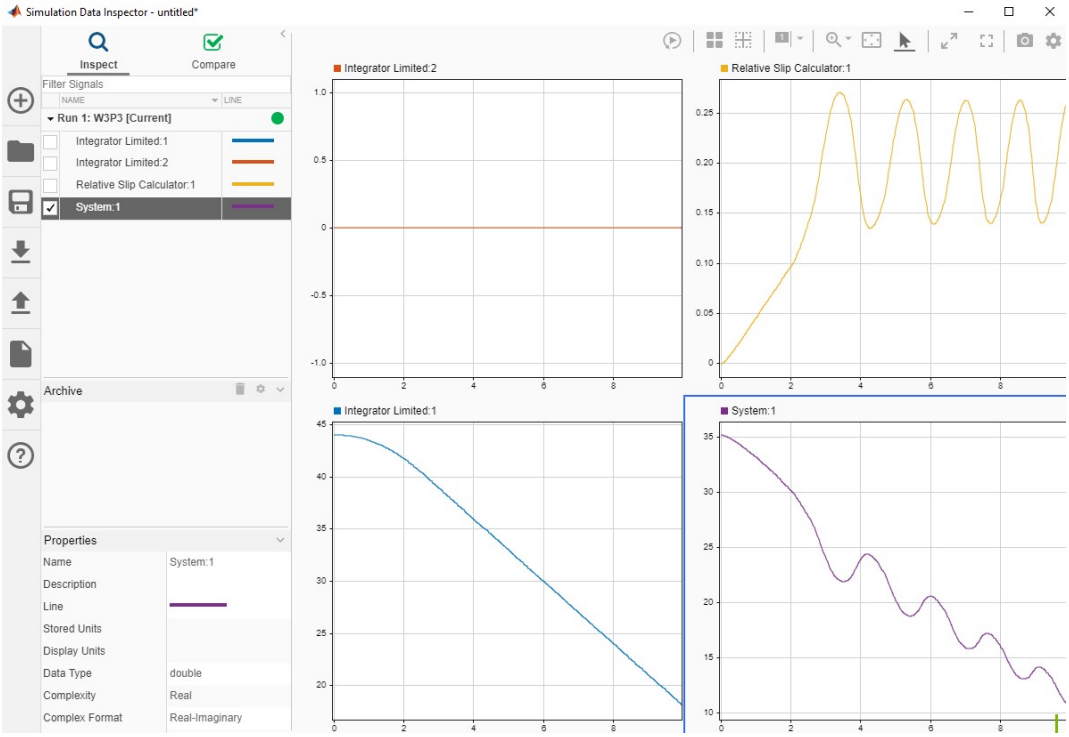
Data dictionary is created so that the sharing of model components values

will be easier.

Name	Value
I	6
R	1.25
Sig	
Sig1	
g	9.81
m	75
v0	44

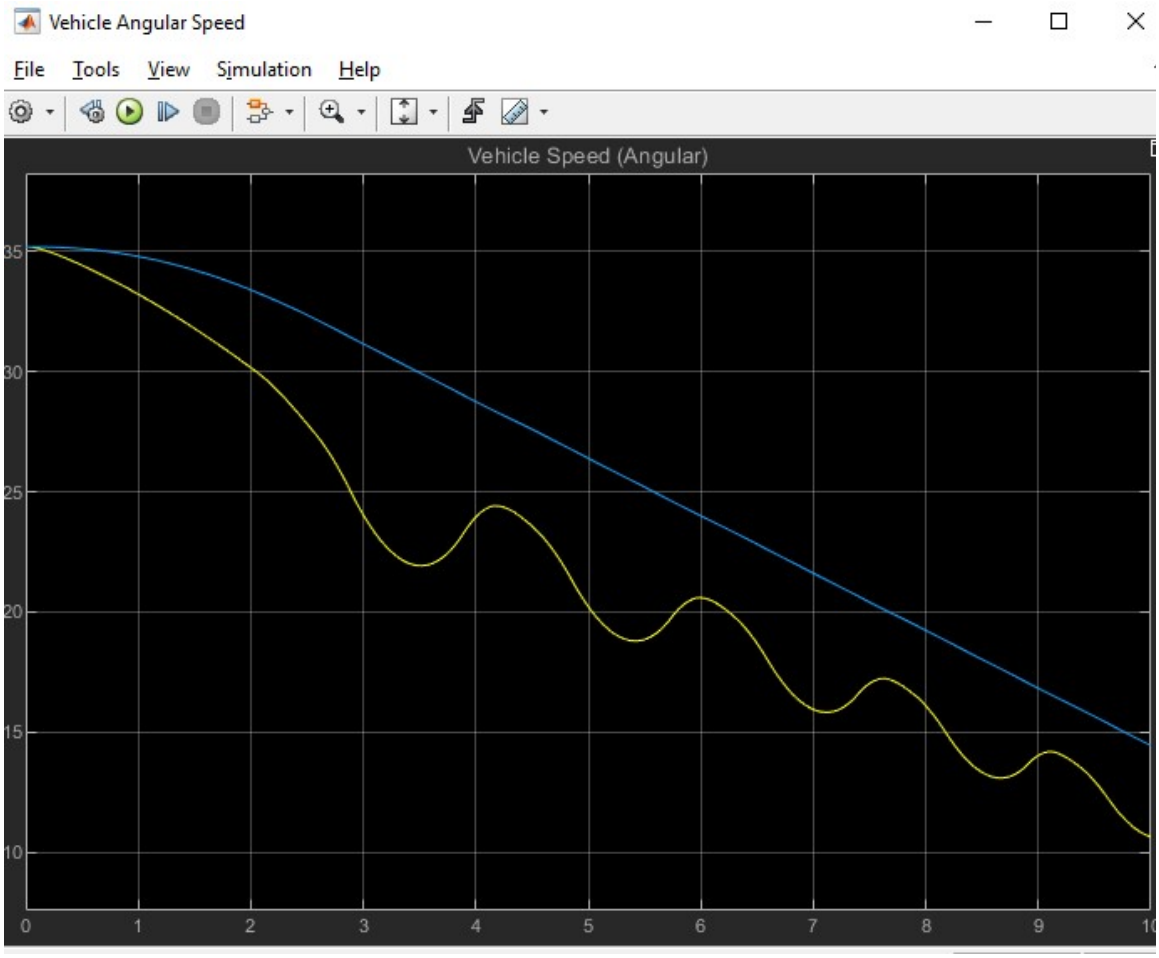
Data Inspector:

Data logging is done so that we can log simulation data to the workspace or to a temporary file on disk for debugging and verfication. Data Inspector lets us analyze how internal block variables change with time during simulation.



Results:

Vehicle speed and wheel speed with ABS.



Conclusion:

- It is infered that ABS improves the braking performance.

- The stopping distance after using ABS system has considerably reduced.

- The error in slip and desired slip is used to manipulate brake pressure in brake cylinder.