
UPPSALA
UNIVERSITET

# Model Based Design of Embedded Systems
# 1DT059
# Report A2

Simulink Matlab

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September 15, 2020

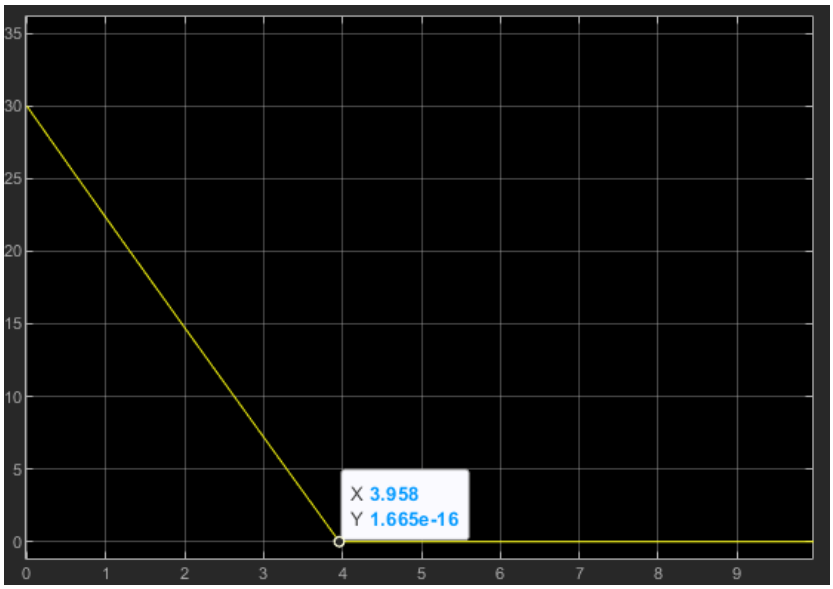
# Solution

## a

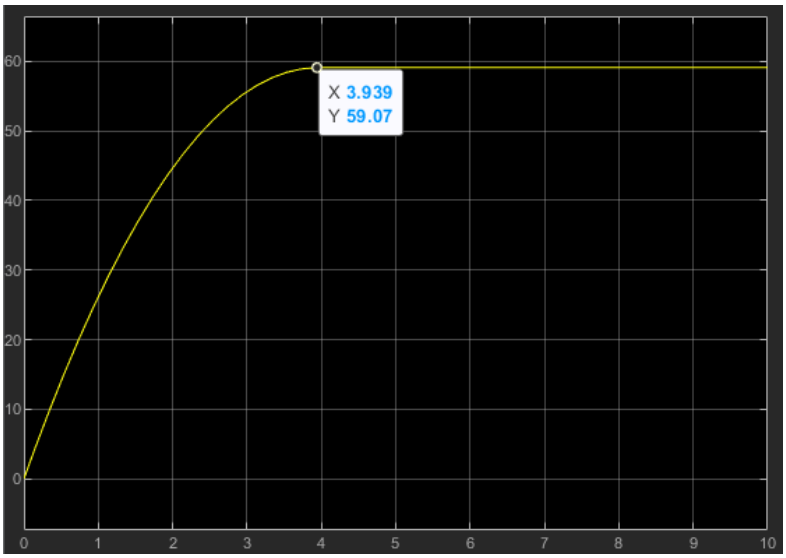
Using the equations which has been provided a suitable model of the car and the wheel has been designed. The angular Momentum was checked and is non-negative.

## b

Simulating the model using the conditions:
MB = 5500Nm
vF = 30m/s
While using these conditions the model takes around 3.985 seconds to come to 0m/s and travels a distance of 59.07m to come to a stop.



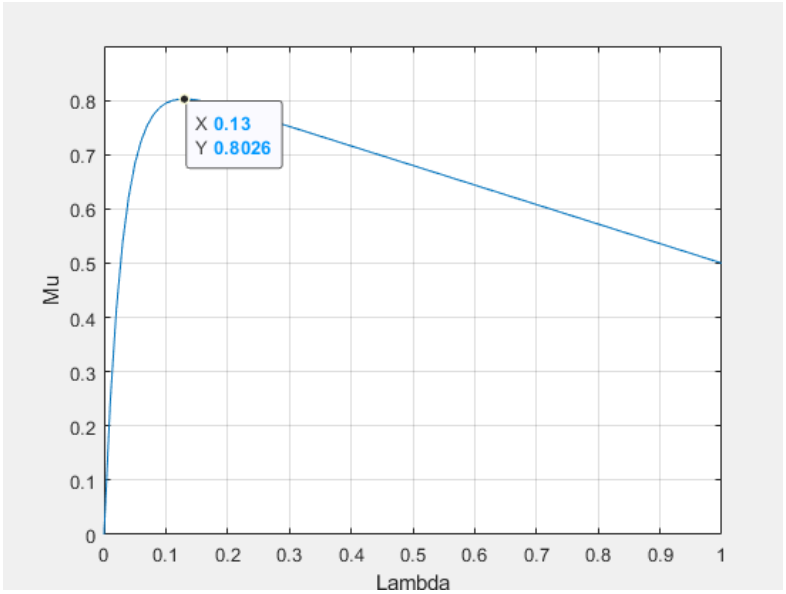

Time taken to stop = 3.958 sec




Distance covered = 59.07 m/sec

**c**

On plotting the function $\mu(\lambda)$ for $0 \leq \lambda \leq 1$, we find the value of $\lambda_{Max}$ to be 0.13. This was achieved by substituting different $\lambda$ values in the equtaion: $\mu(\lambda) = c1.(1 - \exp^{-c2\lambda}) - c3.\lambda$ which can be seen in the graph below



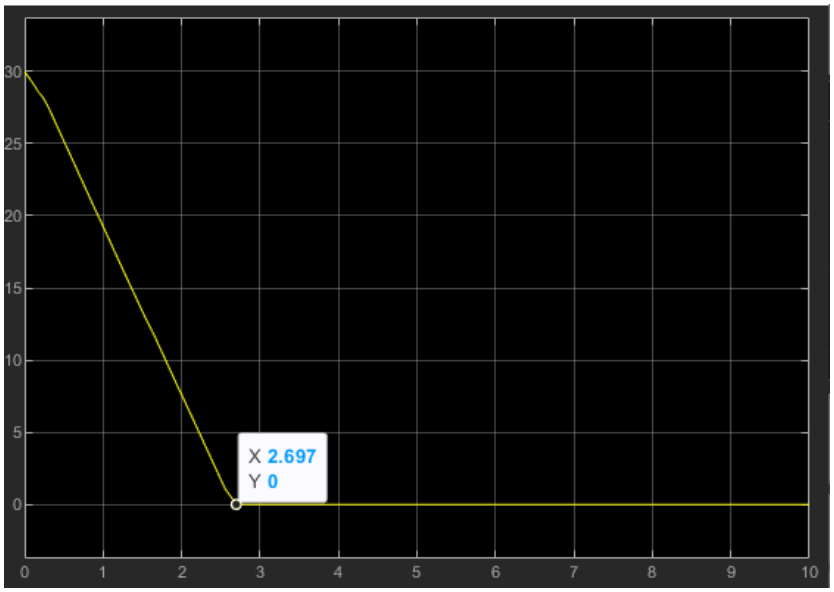

Values of $\mu$ vs $\lambda$

## d

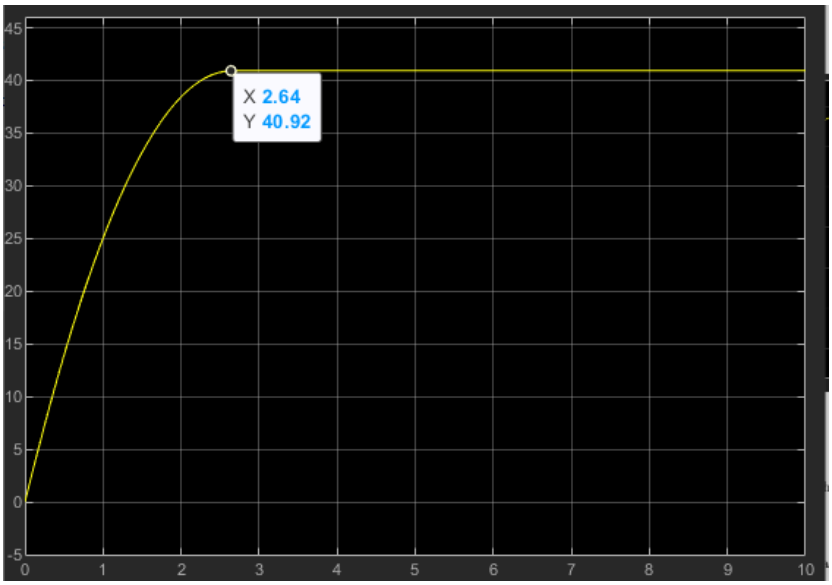
The controller which improves the breaking and stops the car from suddenly stopping has been designed to produce a value $\Delta(t)$ which is added along with the breaking momentum $M_B and is simulated$.

## e

After designing the controller, the input is then $\Delta(t) + M_B$ and initial speed $v_F = 30m/s$. It takes the car 2.697 seconds to come to a halt and travels around 40.92m distance to come to a stop. The graph for the same has been shown below.




Time taken to stop = 2.697 sec




Distance covered = 40.92m