**Application: Conventional Vehicle Model Questions**

Develop a conventional vehicle model using the previously generated Driver-Glider models, as well as creating power loss models for both an engine and driveline. The driver model should no longer command a tractive effort, but should now command an APP in percentage to the engine. The engine should then use this percentage to generate output power based on the maximum engine power provided. (50% APP = 50% Max engine power).

The power that the engine outputs should be the power that drives the driveline.

The driver model should also generate a brake force in N based off of the negative accelerator pedal positions output by the PID controller. Use an appropriate gain to scale the APP to a force. Keep in mind typical vehicle behavior, for example if the vehicle is stopped, the brake force should be active and the vehicle should not move backwards because of this. Using the input power and input brake force, the driveline should calculate the Ftr that goes into the glider model.

Use the following parameters in generating your conventional vehicle model:

* Coefficient of Rolling Resistance (c\_rr): 0.01
* Coefficient of Drag \* Frontal area (CdAf): 0.76 m2
* Air Density (rho): 1.2 kg/m3
* Vehicle Mass (m): 1700 kg (conventional vehicle test mass)
* Inertial Mass (mi): 1.04\*m
* Road Grade (%): 0
* Gravitational Constant (g): 9.81 m/s2
* Maximum Tractive Force (Ftr\_max): 8 kN
* Maximum Tractive Power (Ptr\_max): 110 kW
* Accessory Load (AccyLoad): 0.60 kW
* Maximum Brake Force (BrakeF\_max): 10 kN
* Engine Model Loss Coefficients: C0 = 20 kW, C1 = 1.3, C2 = 0.0042 1/kW
* Driveline Model Loss Coefficients: C0 = 0.6 kW, C1 = 0.012, C2 = 0.00049 1/kW
* Gasoline LHV: 44400 J/g

Use the generated model to run the UDDS, HwFET, and US06 Cycles and answer the following questions:

Using the given power loss parameters for the engine, run the UDDS cycle and find the fuel economy in MPG for the vehicle model.

|  |  |  |
| --- | --- | --- |
|  | 25 mpg |  |
|  | 19 mpg |  |

|  |  |  |
| --- | --- | --- |
|  | 32 mpg |  |
|  | 21 mpg |  |

The EPA test car data for a 2012 Malibu yields a UDDS fuel economy of about 21.9 mpg, and an HwFET fuel economy of about 36.4 mpg. Tune the loss coefficients of your engine (Primarily C0, slight C1) in order to match these mpg numbers. Are you able to obtain values that match for both the UDDS and HwFET?



Judging by the losses accumulated by each of the powertrain components, which component produces more losses? What can be concluded about losses vs. powertrain efficiency when comparing the US06 Cycle to the other drive cycles?

 