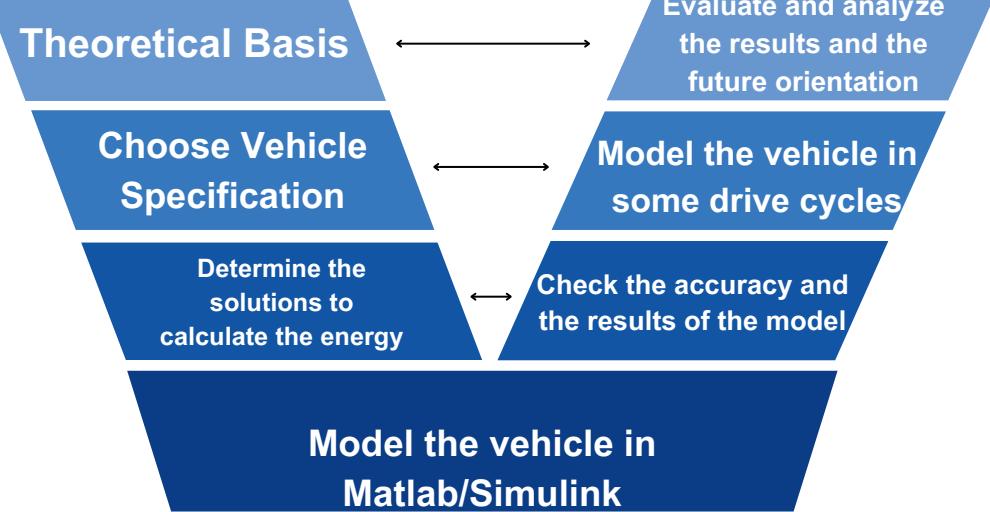


ENERGY BALANCE ANALYSIS IN VEHICLE LONGITUDINAL MOTION USING MATLAB/SIMSCAPE

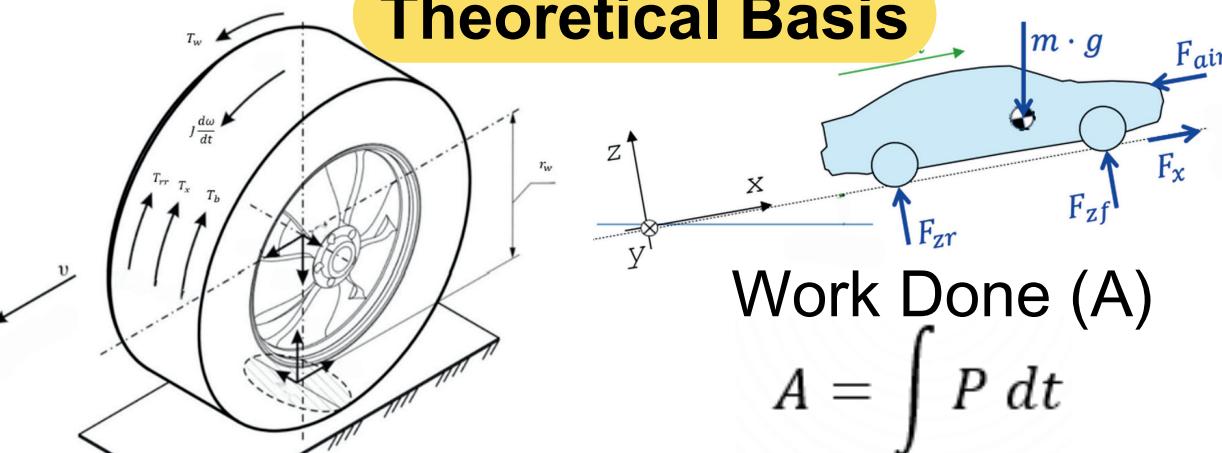
Introduction

- Objective: Determining and explaining each energy component of longitudinal dynamic of vehicle during acceleration and deceleration, drive cycle (FTP – 75, NEDC, JP1015).
- Scope of Study: The model just focus about the result of longitudinal motion and eliminating the transversal and vertical motion of the vehicle. In addition, the grading force is negligible.

Process



Theoretical Basis



General energy balance equation

$$\Delta KE = A_{\text{engine}} - A_{\text{braking}} - A_{\text{resistive}}$$

Acceleration

$$A_t = A_{\text{vehicle inertia}} + A_j + A_{\text{aero}} + A_{rr} + A_{\text{fricmech}}$$

Deceleration

$$A_{\text{vehicle inertia}} + A_j = A_{\text{brake}} + A_{\text{aero}} + A_{rr} + A_{\text{frictrans}}$$

Specification

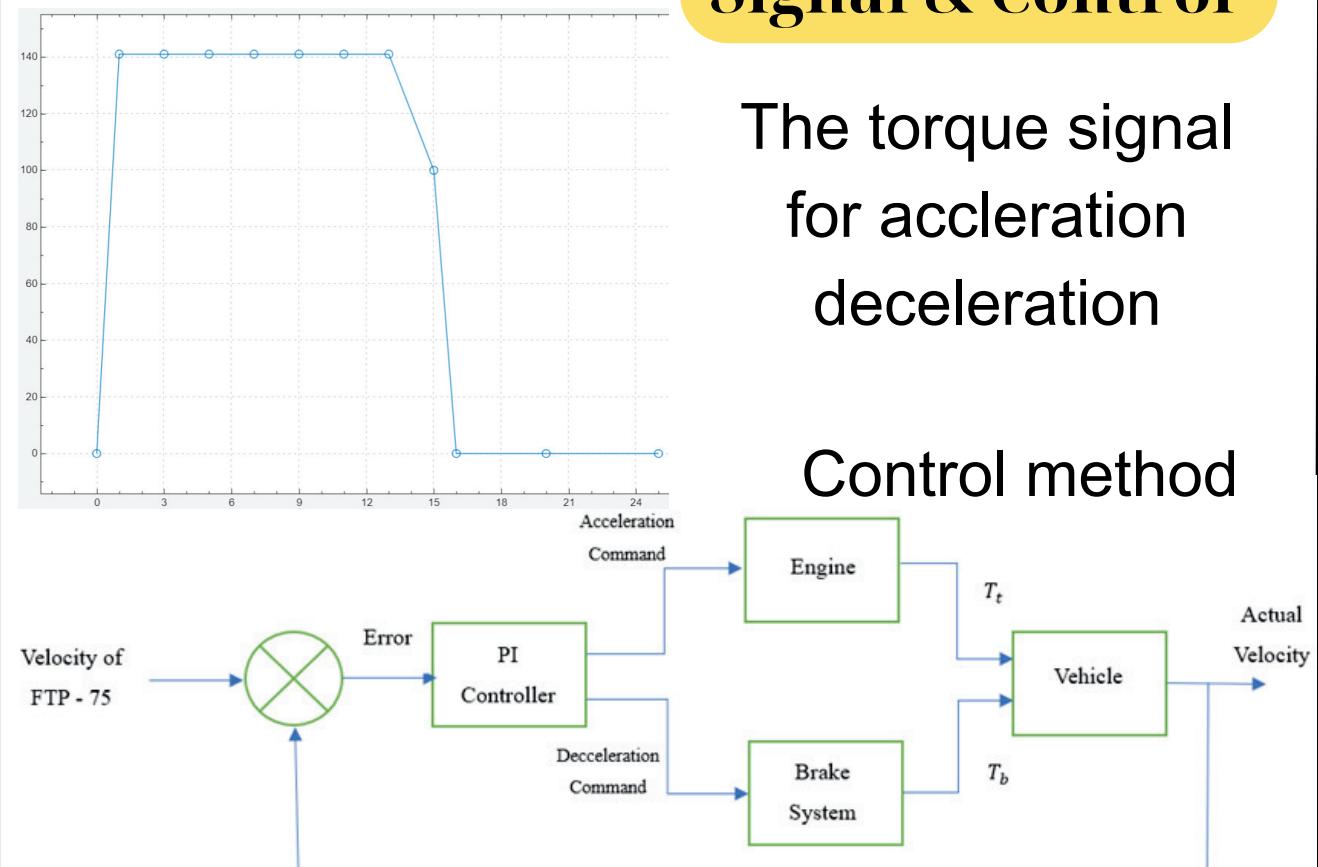
Mitsubishi Xpander
2020

Specification	Value
Overall (mm)	4475 x 1750 x 1730
L_0	2775
m_{ve}	Kerb weight (kg)
m_{ref}	Gross weight (kg)
a/b	the horizontal distance between the centre of the vehicle and front and rear axle, respectively (mm)
h_q	The height from the center of vehicle to road (mm)
r_{axc}	The tire radius (m)
A_{disc}	Front/rear track (mm)
A_{drum}	Front brake
	Rear brake
	Area of disc brake (mm²)
	drum
	Area of drum brake (mm²)

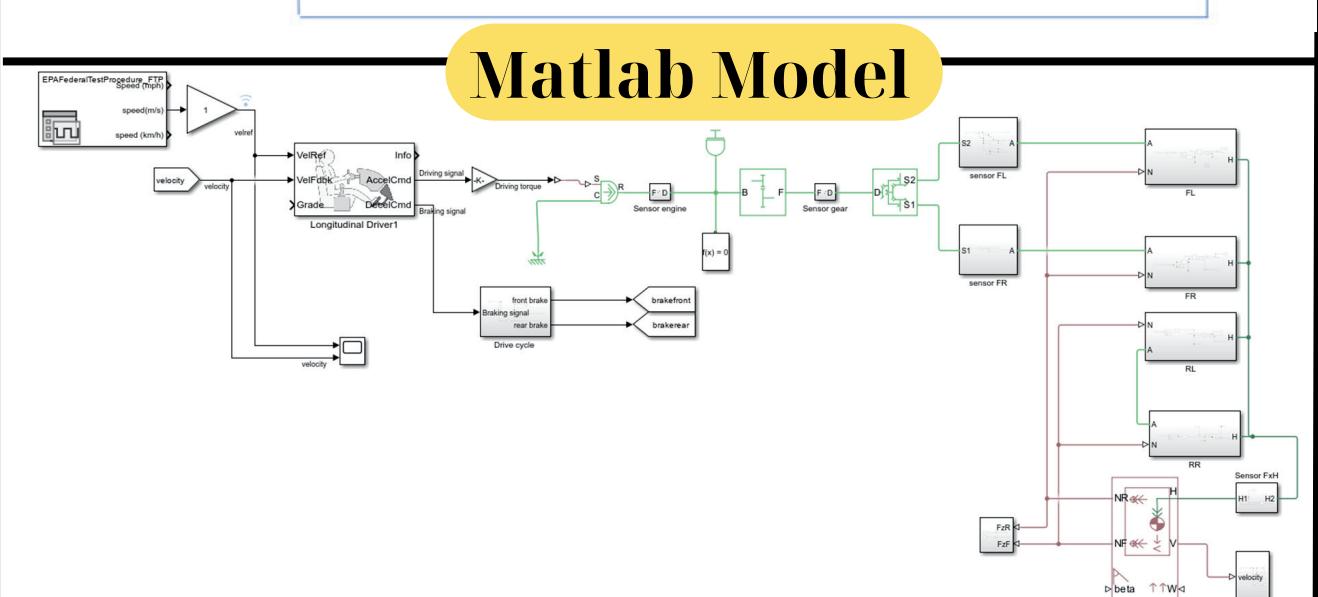
Signal & Control

The torque signal for acceleration deceleration

Control method



Matlab Model

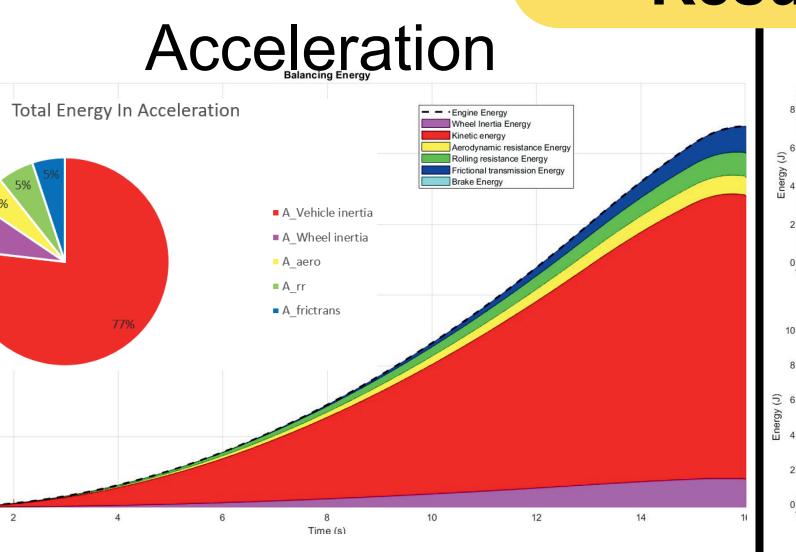


Conclusion

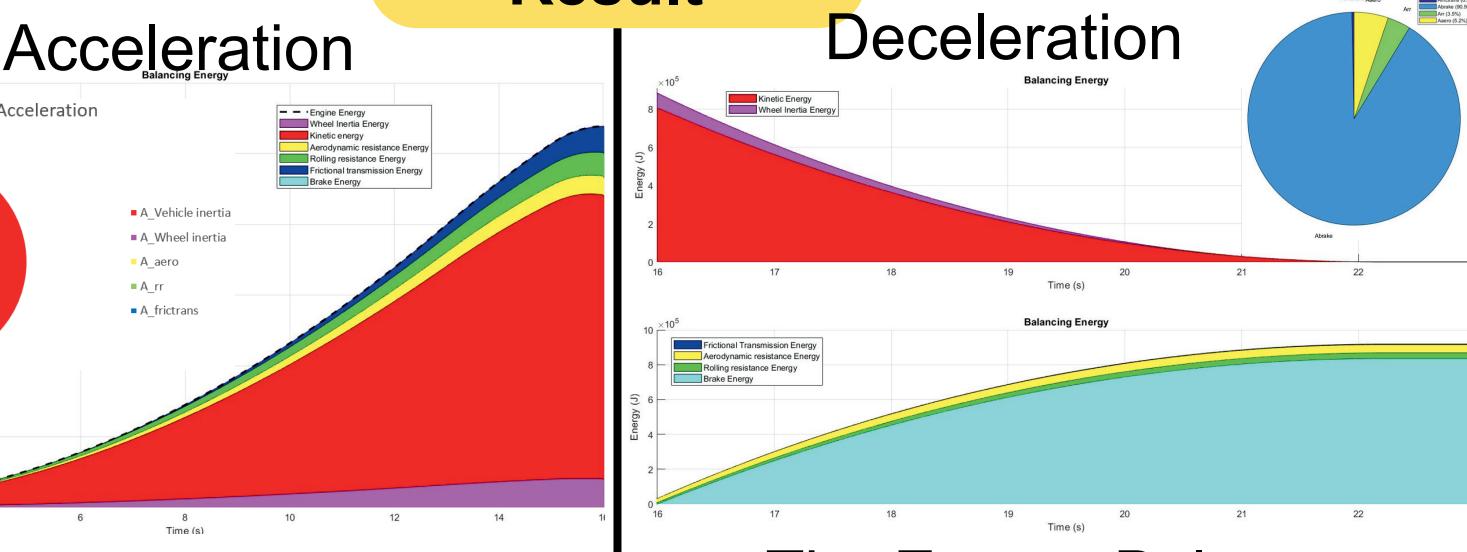
- The theoretical basis is similar with the Matlab model.
- During Acceleration/Deceleration, the resistive energy of vehicle is determined.
- Determining and analyzing each energy component in the drive cycle

Result

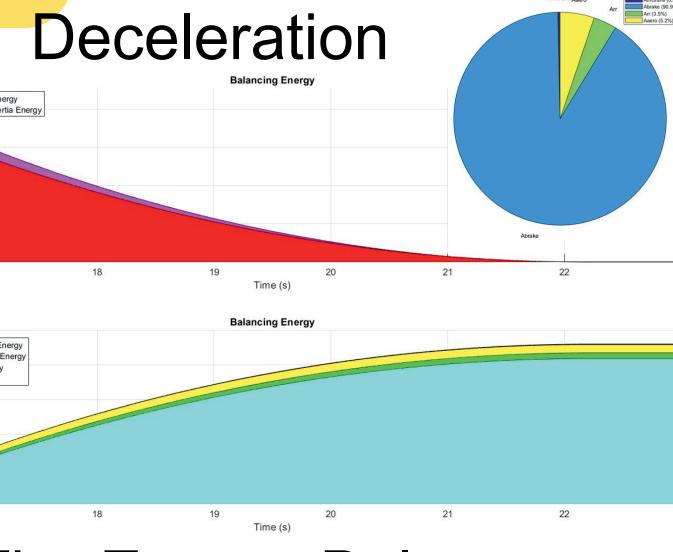
Acceleration



The Energy Balance



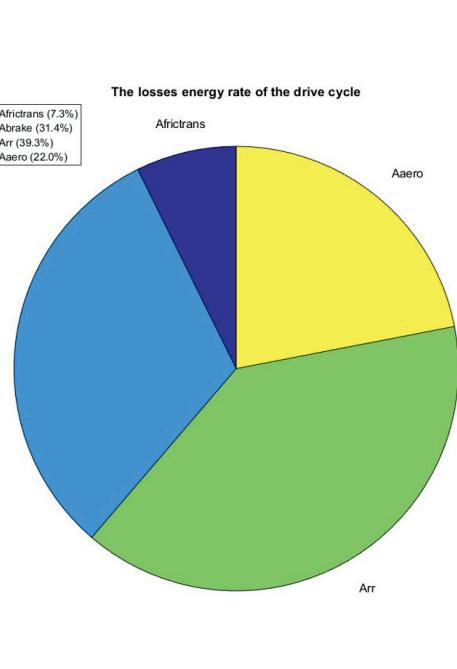
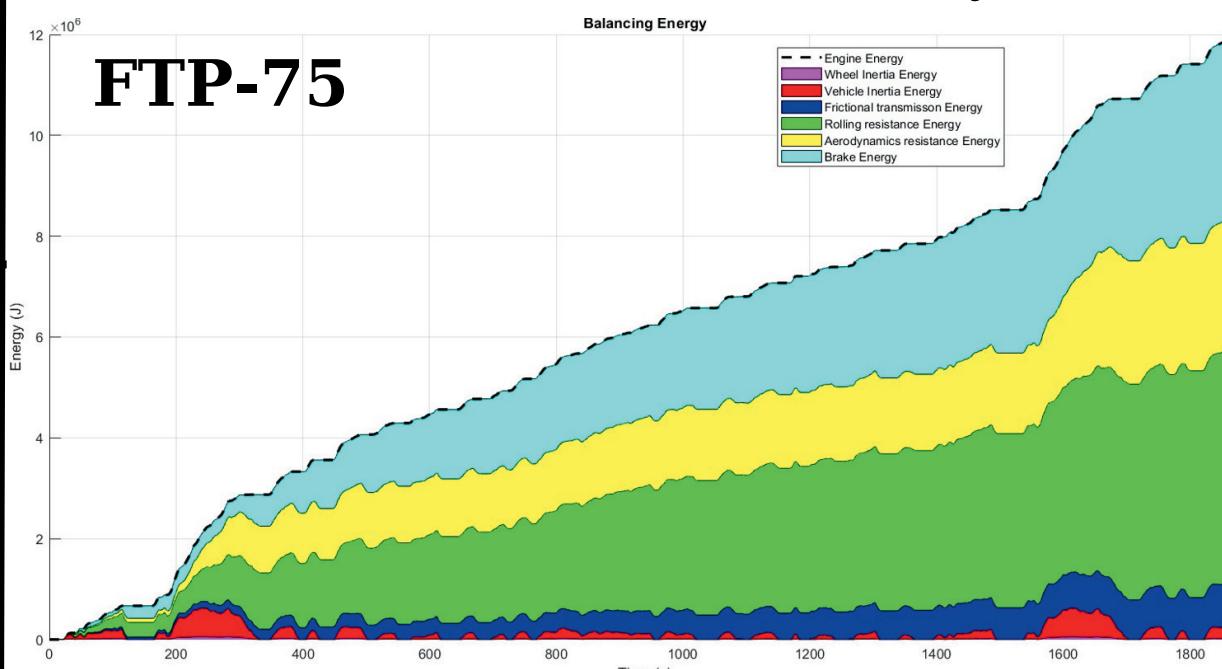
Deceleration



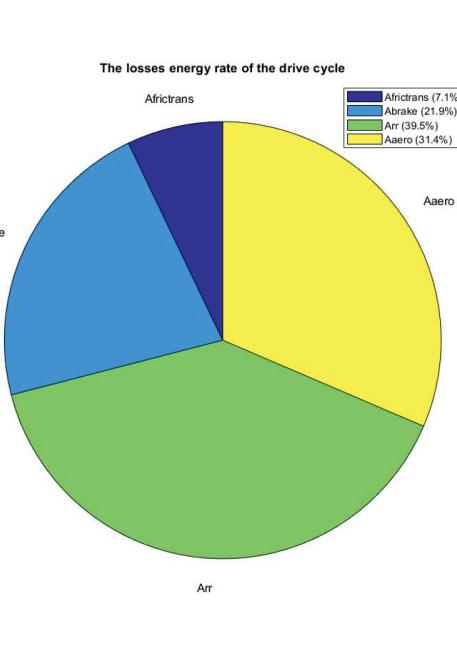
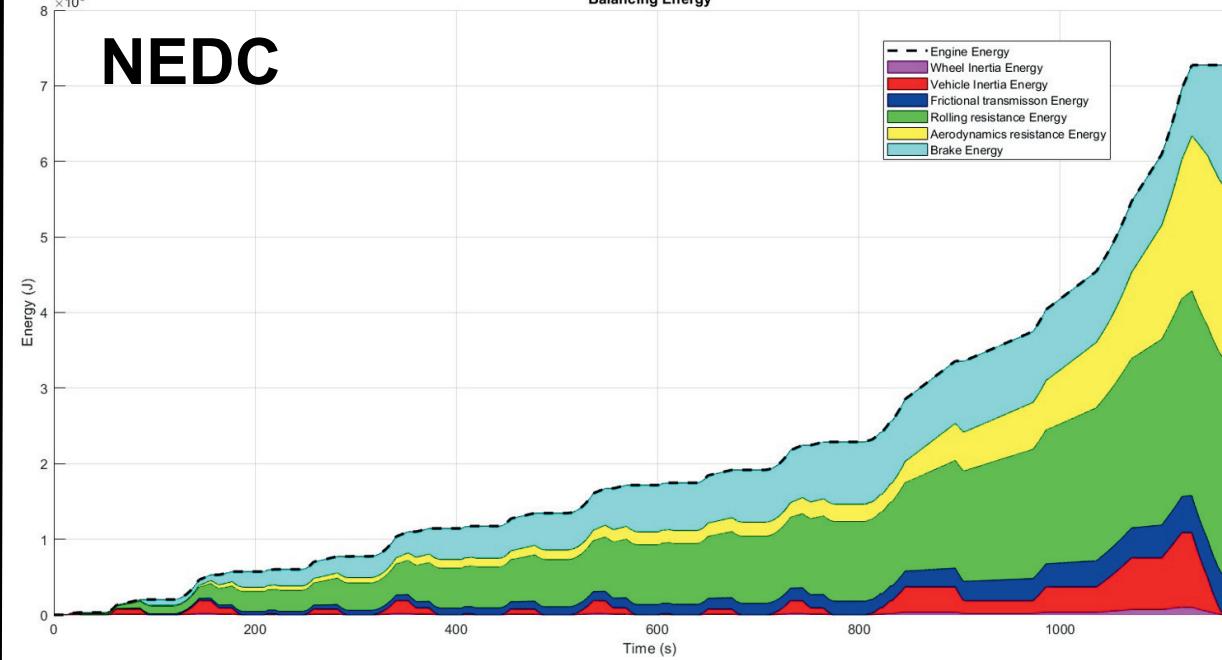
The Energy Balance

Drive Cycle

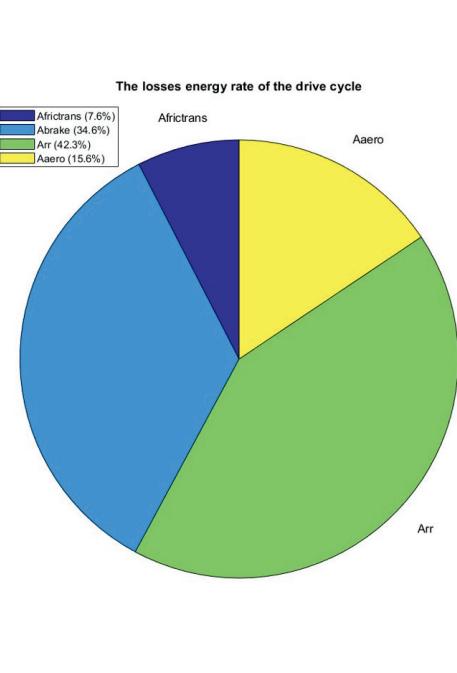
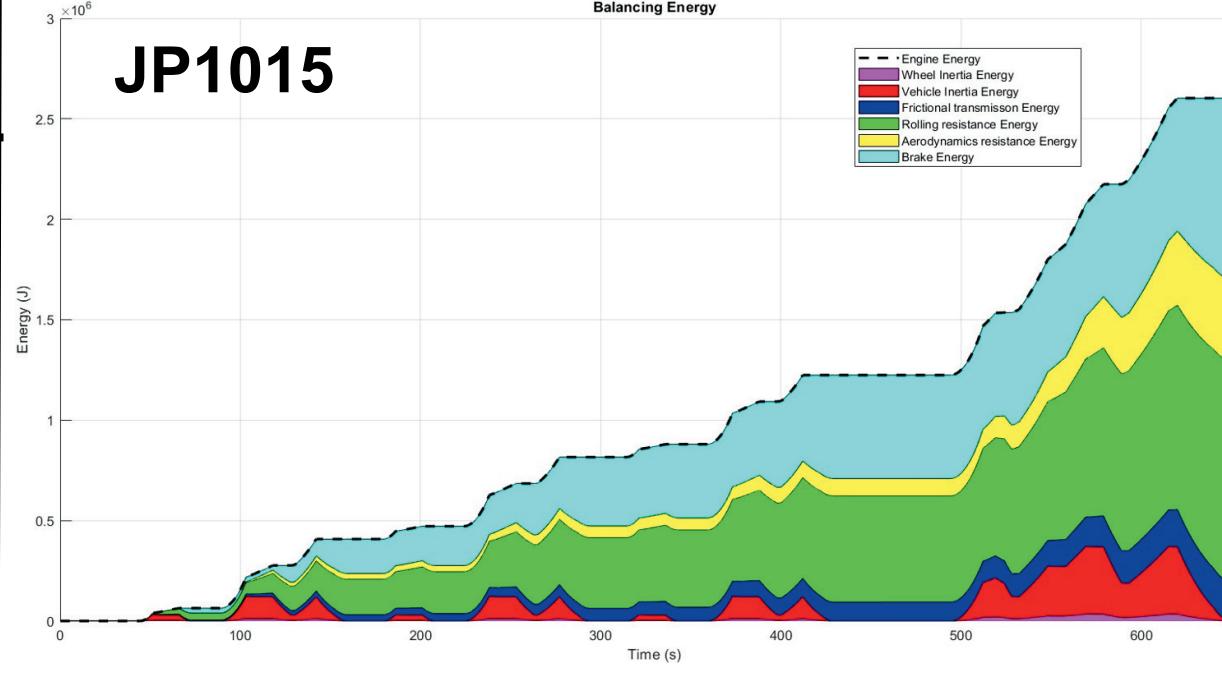
FTP-75



NEDC



JP1015



Future Work

- Enhancing the model with the specification is nearly same as the actual specification of vehicle.
- Studying the slip friction and applying to the model.
- Studying and applying regenerative brake for the model.