Detailed automatic transmission modelling in GT-SUITE

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Agenda

- Background
- 1-D Transmission analysis
- Objective
- Simulation Methodology
- Components Modelled
- Result Comparison
- Summary
- Acknowledgement
Background

1-D analysis plays a major role in deciding engine-transmission combination, for better fuel economy, performance and maximum vehicle towing capacity.

Different types of analysis are performed on automatic transmission for designing durable gears, shafts and bearings.

It is crucial to have correct transmission ratio and final drive ratio for the vehicle to perform in desirable way.

Shift quality plays an important role in driving comfort.

Finally to make sure transmission will not fail within warranty period.
Typical 1-D Transmission analyses

- Performance
- Fuel Economy
- Drivability

- Transmission durability analysis
- Virtual Transmission test bench
- Spare tire test
- Drive line torsional analysis
- Dynamic dutycycle
- Ice clunk
- Panic braking

- TCC temperature estimation
- Transmission thermal analysis
Objective

- 1-D Model which can predict the shift dynamics and corresponding reaction of transmission components.
- Benchmarking of GT-SUITE with commercially available software for automatic transmission modelling
- Pros and Cons of GT-SUITE model with respect to validated internal model
GM Vehicles with 8 Speed transmission

CADILLAC ATS-V

CHEVROLET SILVERADO

CHEVROLET CAMARO SS

CORVETTE STINGRAY

CHEVROLET EXPRESS
Simulation Methodology

- System is modelled from engine crank shaft to transmission output shaft (includes torque converter as well)
- Engine torque is imposed on the crank shaft
- Transmission output speed imposed on the transmission output shaft
- Vehicle is ran from 0kph to 30kph (as per vehicle test data)
- Study is performed for following upshifts i.e. 1 to 2, 2 to 3
- Comparison has been done with validated internal model for Input speed, Output torque, Clutch torque, Clutch Clamp force, Clutch slip and Clutch Piston displacement
Components Modelled

- Piston Return Damping
- Contact clearance
- Piston Return Damping
Transmission Overview

Overall transmission

Clutch system
Result Comparison

Transmission Input Speed

Transmission Output Torque
Summary

- Detailed transmission with all the components which directly involve in gear shift has been modelled
- Clutch system captured the shift dynamics for the given maneuver
- Results of GT-SUITE model are as per expectation and can be used for further studies
- For certain elements representative components have been used to perform equivalent function
- Validation has to be performed for the remaining shifts along with torque converter clutch actuation
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