AE548/ME548 Project
Simulation and Analysis of Shift Processes of a 6-speed FWD AT

The objective of the project is to simulate and analyze the fixed gear operations and shift processes of a 6-speed FWD AT (shown on the next page) with a final drive ratio of 2.6. The following tasks must be completed for the project:

a. Select the data for a midsize car needed for the project, including the dimensional and weight data, engine data, torque converter data, tire dimension, mass moments of inertia, etc.
b. Establish the mathematic model for the transmission-vehicle system, i.e., the general state variable equation, specific state variable equation, initial conditions, etc., for the 1^{st} gear operation, the 1-2 shift, and the 2^{nd} gear operation.
c. Solve the state variables by hand in terms of input variables and control variables for the 1^{st} gear operation, the 1-2 shift, and the 2^{nd} gear operation.
d. Use the formulation in c) to simulate the launch of the vehicle from rest in 1^{st} gear, a 1-2 shift initiated at a speed of 15 mph, and 2^{nd} gear operation for 2 second after the 1-2 shift with an open torque converter and a fixed throttle position.

Note: You need to optimize the clutch torque profiles for shift quality. As the output, you need to provide the following plots:

. Engine torque V.s Time
. Transmission input torque V.s Time
. Transmission Output torque V.s. Time
. Clutch Torque Profiles V.s Time

Note: The six variables above must be clearly plotted in the same plot.

. Engine RPM V. s. Time
. Transmission input and output angular velocities in RPM Vs. time
. Angular velocities of sun S_1 and carrier C_1 in RPM V.s. Time

Note: The five variables above must be plotted in the same plot.

. Vehicle speed and acceleration V.s. Time

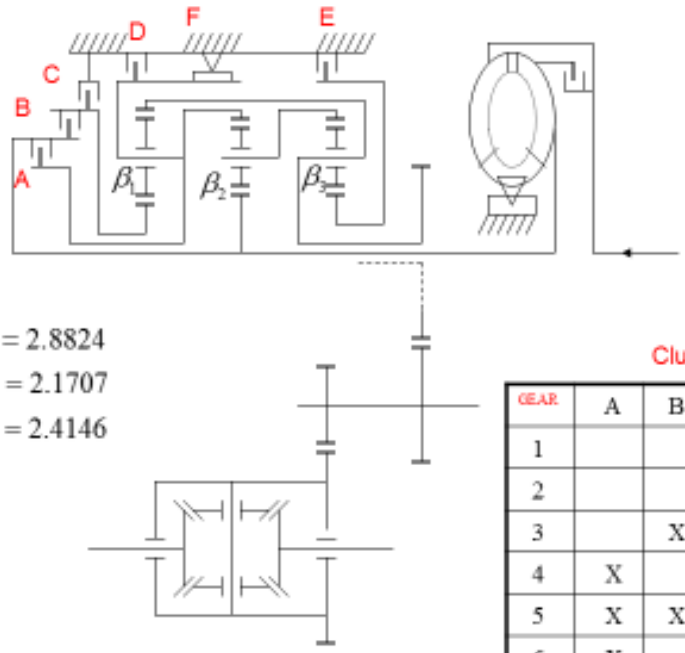
Note: These two variables must be plotted in the same plot.

e. Submit the **typed** project report that documents the following: data used (in the form of pictures or tables), assumptions, formulation of the simulation modeling, results and plots, self-assessment, etc.

Note:
a. Make a copy of the report for your own record.
b. Pictures must be drawn by computer.

c. Submit the project report in PDF in Canvas on Tue., April 11 (The due time is for both regular and online sessions.)

A 6-speed FWD Automatic Transmission



$\beta_1 = 2.8824$
$\beta_2 = 2.1707$
$\beta_3 = 2.4146$

Clutch Table

GEAR	A	B	C	D	E	F
1					X	X
2			X		X	
3		X			X	
4	X				X	
5	X	X				
6	X		X			
R		X		X		