Altair

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Altair MotionView 2019 Tutorials

MV-8003: Gear and Clutch Control

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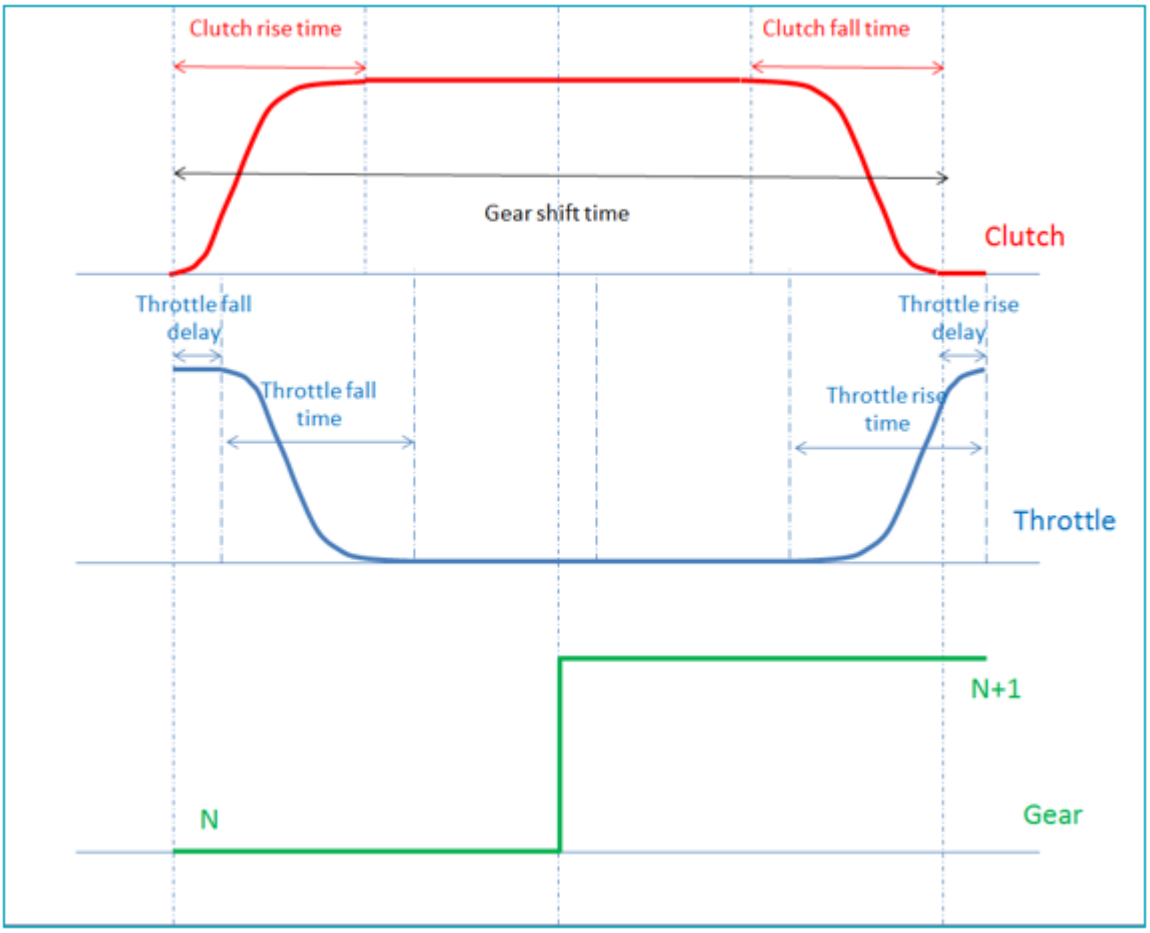
MV-8003: Gear and Clutch Control

In this tutorial, you will learn how to:

- Interfacing gear clutch control for vehicles with manual transmission

Gear clutch controller

The Engine speed based shift controller upshifts whenever engine speed goes above the upshift RPM, and it downshifts when the engine speed goes below the downshift RPM. The Gear shift controller also controls the throttle and clutch signal as shown in the figure below.



Exercise

Step 1: Assembling the vehicle.

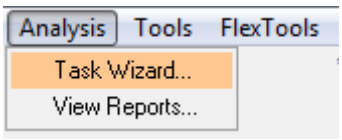
1. Follow the instructions in Step #1 of MV-8000 to create the vehicle with the topology as provided below.

Page	Label	Selection	Default (Yes/No)
1	Model type	Full vehicle with advanced driver	No

Page	Label	Selection	Default (Yes/No)
2	Driveline configuration	Front wheel drive	Yes
3	Vehicle body	Body	Yes
3	Front suspension	Frnt macpherson susp (1 pc. LCA)	Yes
3	Steering linkages	Rackpin steering	Yes
3	Rear subframe	None	Yes
3	Rear suspension	Rear quadlink susp	Yes
3	Powertrain	IC engine friction clutch (manual)	Yes
3	Signal generator	Driver signal generator	Yes
3	Tires	FIALA/HTIRE	Yes
4	Steering column	Steering column 1 (not for abaqus)	Yes
4	Steering boost	None	Yes
5	Front struts	Frnt strut (with inline jts)	Yes
5	Front stabilizer bars	Frnt stabar with links	No
5	Rear struts	Rear strut (with inline jts)	Yes
5	Rear stabilizer bars	Rear stabar with links	No
6	Front jounce bumpers	None	Yes
6	Front rebound bumpers	None	Yes
6	Rear jounce bumpers	None	Yes
6	Rear rebound bumpers	None	Yes
7	Disk brakes	Disk brakes	Yes
7	Front driveline	Independent fwd	Yes
8		Next	No
9		Finish	No

Step 2: Adding driver analysis.

1. Use the Task Wizard to load the driver analysis.



Step 3: Specifying vehicle parameters

1. We are going to use feedforward controllers for velocity profile following. Feedforward controllers model the vehicle and hence, require vehicle parameters. Vehicle parameters need not be precise for controllers to work. Most of the vehicle parameters required by the driver can be automatically calculated from the vehicle model.

Step 4: Writing an Altair Driver File (ADF) driving event .

Example #1 Velocity profile following with gear and clutch controller

We will modify the ADF which was written for MV-8001 (example 3) and incorporate a gear and clutch controller.

1. Open any text editor and copy and paste the following text into it. **Important: All blank lines must be removed prior to saving the file!** Be sure to read through the comments for a better understanding on what is written in the ADF.

```
$----------------------------------------------------------ALTAIR_HEADER
[ALTAIR_HEADER]
FILE_TYPE               = 'ADF'
FILE_VERSION    = 1.0
FILE_FORMAT     = 'ASCII'
$-------------------------------------------------------------------UNITS
[UNITS]
(BASE)
{length  force          angle      mass   time}
'meter'   'newton'      'radians'  'kg'     'sec'
$-----------------------------------------------------------VEHICLE_IC
[VEHICLE_INITIAL_CONDITIONS]
VX0 = -20.0
VY0 = 0.0
VZ0 = 0.0
$-----------------------------------------------------STEERING_STANDARD
[STEER_STANDARD]
MAX_VALUE                       = 3.141593
MIN_VALUE                       = -3.141593
SMOOTHING_FREQUENCY     = 10.0
INITIAL_VALUE           = 0.0
$-----------------------------------------------------THROTTLE_STANDARD
[THROTTLE_STANDARD]
```

```
MAX_VALUE                = 1.0
MIN_VALUE                = 0.00
SMOOTHING_FREQUENCY      = 10.0
INITIAL_VALUE            = 0.2
$-------------------------------------------------------------BRAKING_STANDARD
 [BRAKE_STANDARD]
MAX_VALUE                = 1.0
MIN_VALUE                = 0.0
SMOOTHING_FREQUENCY      = 10.0
INITIAL_VALUE            = 0.0
$-------------------------------------------------------------GEAR_STANDARD
[GEAR_STANDARD]
MAX_VALUE          = 6
MIN_VALUE          = 1
INITIAL_VALUE       = 1
$-------------------------------------------------------------CLUTCH_STANDARD
[CLUTCH_STANDARD]
MAX_VALUE          = 1
MIN_VALUE          = 0
SCALING_FACTOR       = 1
INITIAL_VALUE       = 0.0
$-------------------------------------------------------------MANEUVERS_LIST
[MANEUVERS_LIST]
{ name                  simulation_time  h_max  print_interval}
'MANEUVER_1'            10.0               0.01     0.01
$-------------------------------------------------------------MANEUVER_1
[MANEUVER_1]
TASK = 'STANDARD'
(CONTROLLERS)
{DRIVER_SIGNAL       PRIMARY_CONTROLLER      ADDITIONAL_CONTROLLER}
 STEER               FEEDFORWARD_STEER                  NONE
 THROTTLE            FEEDFORWARD_TRACTION               NONE
 BRAKE               FEEDFORWARD_TRACTION               NONE
 GEAR                GEAR_CLUTCH_CONTROL                NONE
 CLUTCH              GEAR_CLUTCH_CONTROL                NONE
$-----------------------------------------------------STEER
 [FEEDFORWARD_STEER]
TAG                  = 'FEEDFORWARD'
LOOK_AHEAD_TIME      = 0.5
$Instruction to the driver that the path is of type DDF
PATH                 = 'DDF'
$Path of the ddf file, data lies in same folder in file named snet.ddf
FILE                 = 'snet.ddf'
$-------------------------------------------------THROTTLE & BRAKE
[FEEDFORWARD_TRACTION]
TAG                  = 'FEEDFORWARD'
TYPE                 = 'FOLLOW_VELOCITY'
LOOK_AHEAD_TIME      = 0.5
DEMAND_SIGNAL        = 'DEMAND_SPEED'
$-------------------------------------------------------DEMAND_SPEED
```

```
$Block containing all the information about the acceleration profile to be followed
[DEMAND_SPEED]
TYPE                    = 'CURVE'
$Velocity profile information is in the file snet.ddf in the same folder
$Velocity profile is defined under the column name DV in the DDF
${X       Y       Z       DV}
FILE                    = 'snet.ddf'
DEMAND_VECTOR           = 'DV'
$Gear clutch controller
[GEAR_CLUTCH_CONTROL]
TAG = 'ENGINE_SPEED'
(GEAR_SHIFT_MAP)
{G  US     DS     CT     CRT    TFD    TFT    CFT    TRD    TRT}
1   650    285    0.45   0.05   0.1    0.1    0.05   0.05   0.05
2   650    285    0.45   0.05   0.1    0.1    0.05   0.05   0.05
3   650    285    0.45   0.05   0.1    0.1    0.05   0.05   0.05
4   650    285    0.45   0.05   0.1    0.1    0.05   0.05   0.05
5   650    285    0.45   0.05   0.1    0.1    0.05   0.05   0.05
```

2. ***Run*** the simulation  .
3. Observe the results.