Tire Modeling and Analysis

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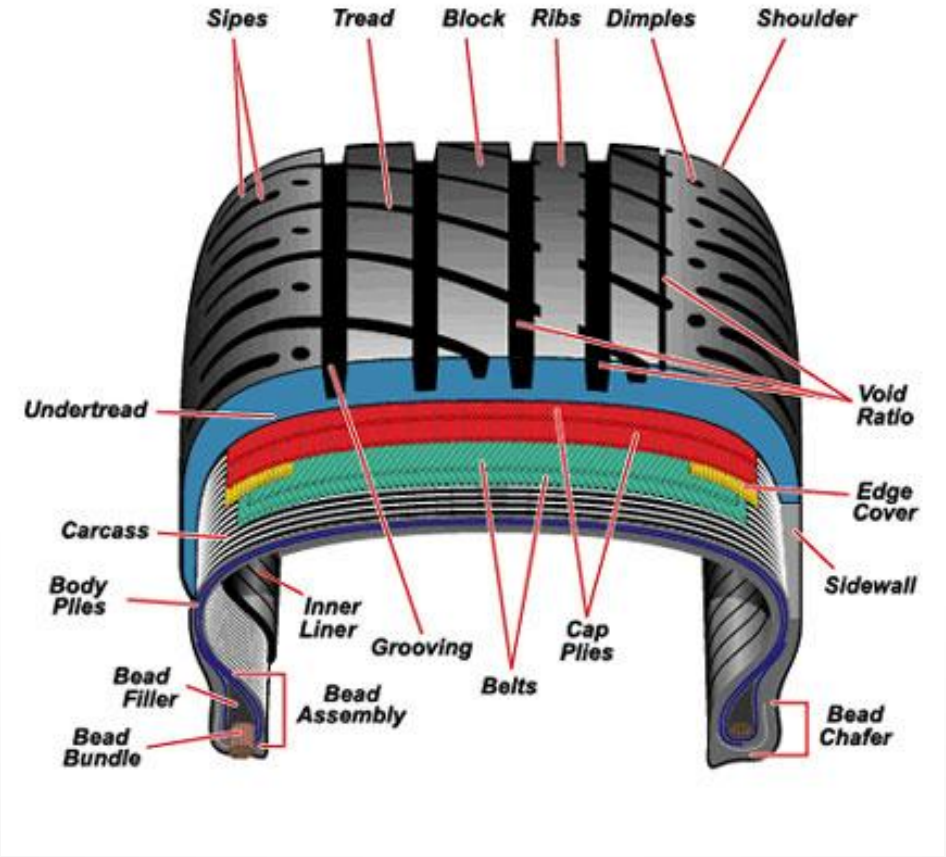
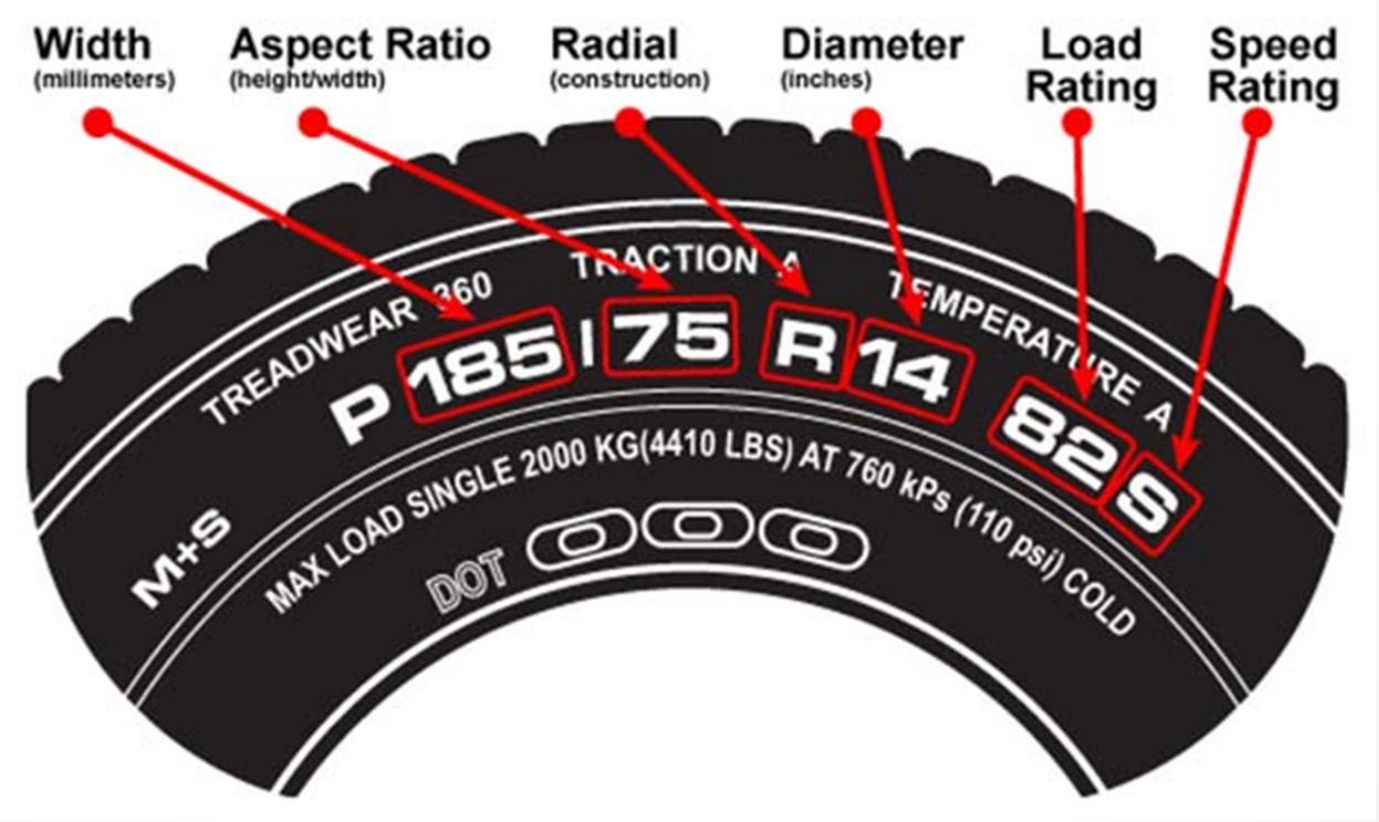
MEENU AGRAWAL

INTRODUCTION

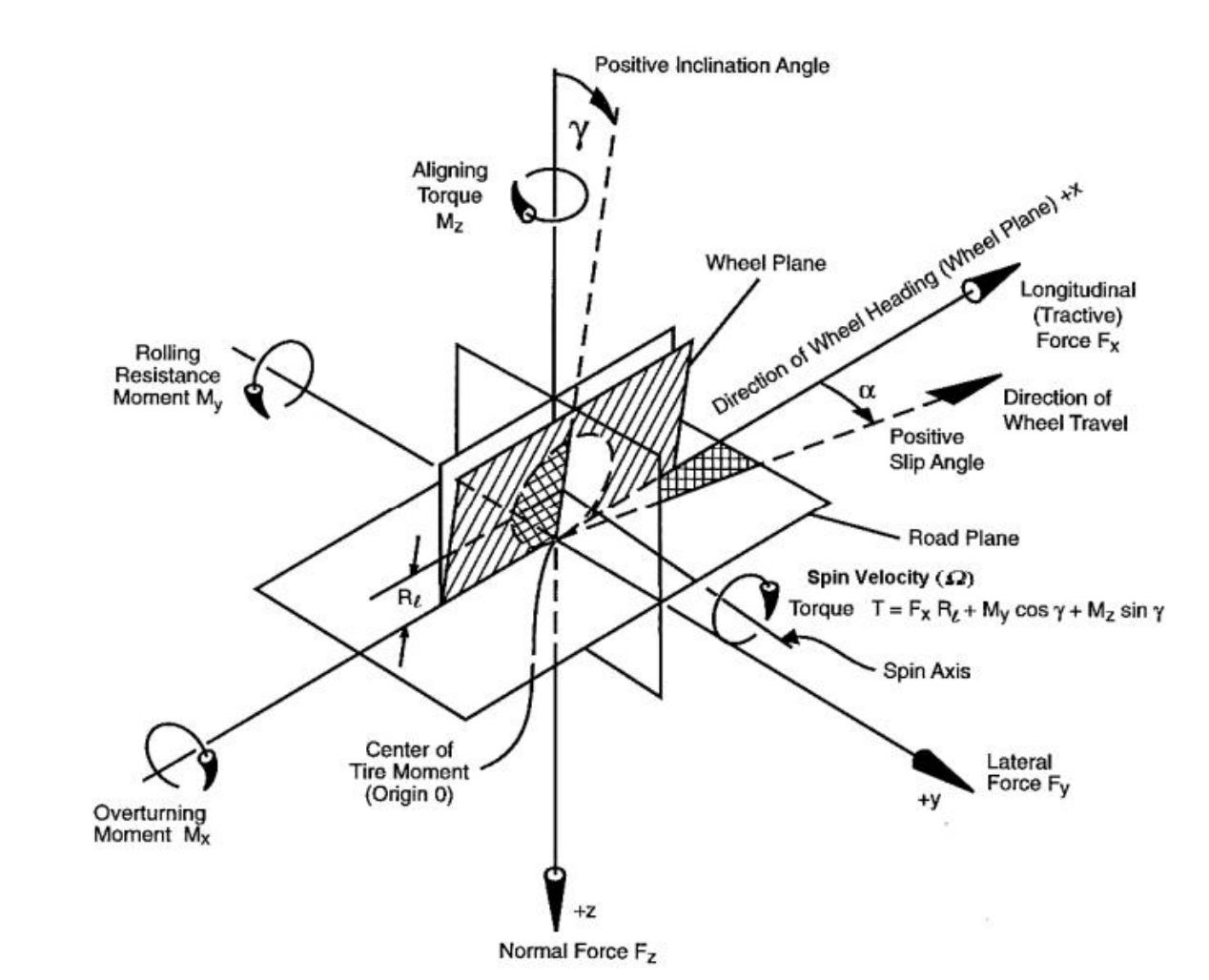
Tire Components



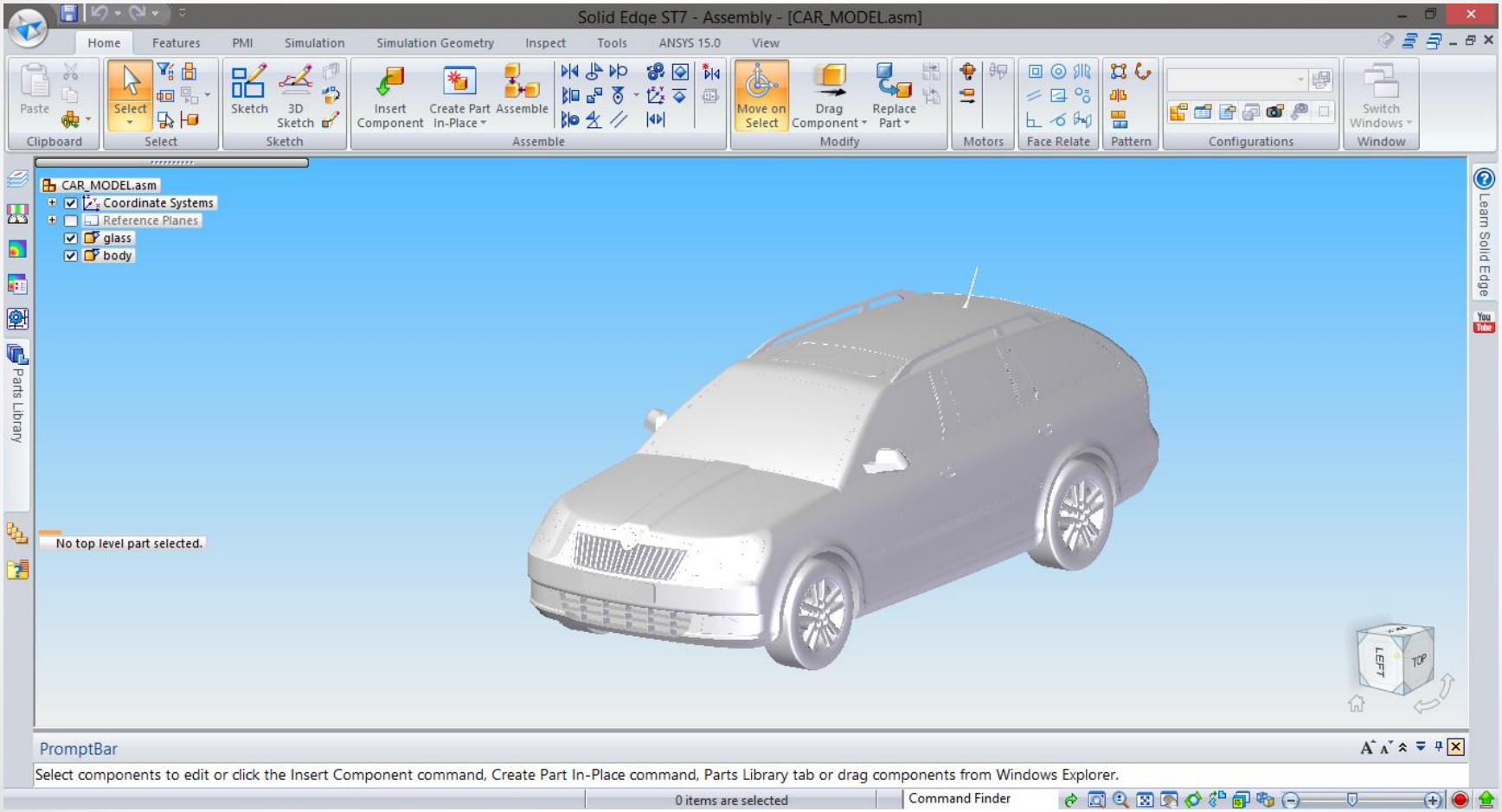
Tire Nomenclature



Tire Axes Terminology

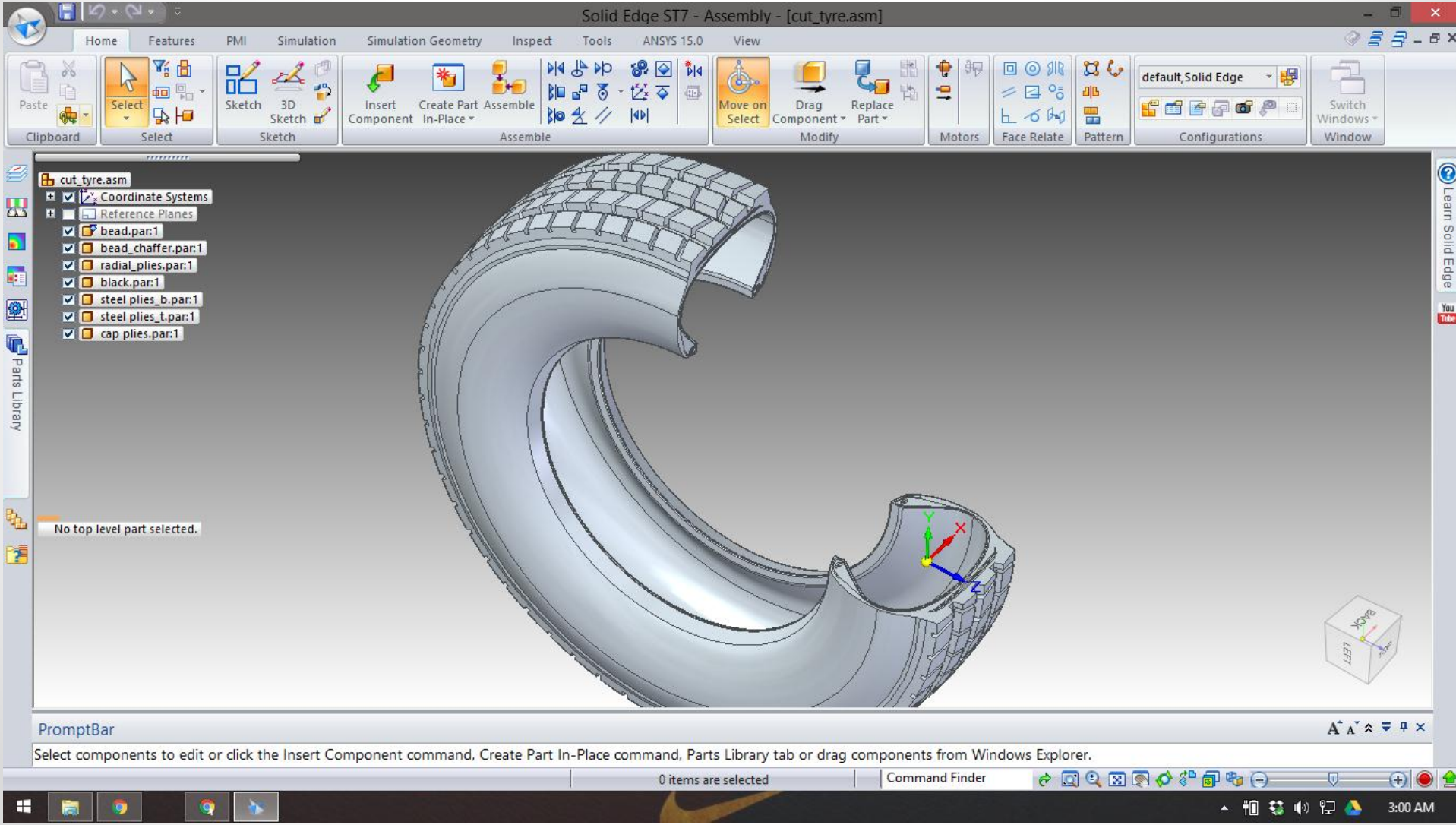


CAR MODEL


Solid Edge ST7 - Assembly - [CAR_MODEL.asm]
Home
Features
PMI
Simulation
Simulation Geometry
Inspect
Tools
ANSYS 15.0
View
Paste
Select
Sketch
3D Sketch
Insert Component
Create Part In-Place
Assemble
Move on Select
Drag Component
Replace Part
Switch Windows
Clipboard
Select
Sketch
Assemble
Modify
Motors
Face Relate
Pattern
Configurations
Window
CAR_MODEL.asm
Coordinate Systems
Reference Planes
glass
body
No top level part selected.
Parts Library
Learn Solid Edge
PromptBar
Select components to edit or click the Insert Component command, Create Part In-Place command, Parts Library tab or drag components from Windows Explorer.
0 items are selected
Command Finder

….rendered model in KeyShot

TIRE MODEL


Solid Edge ST7 - Assembly - [cut_tyre.asm]
Home
Features
PMI
Simulation
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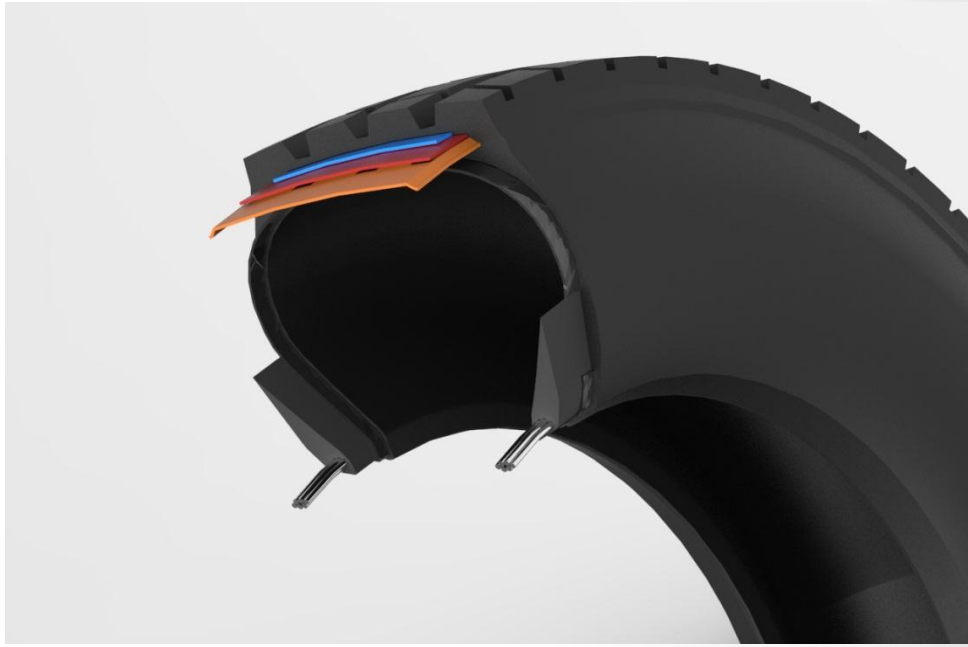
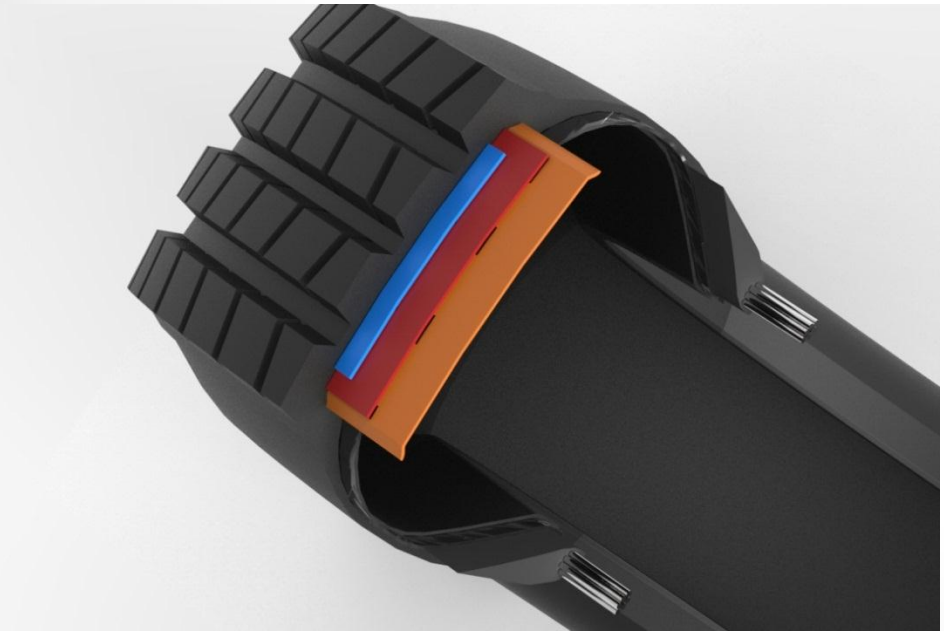
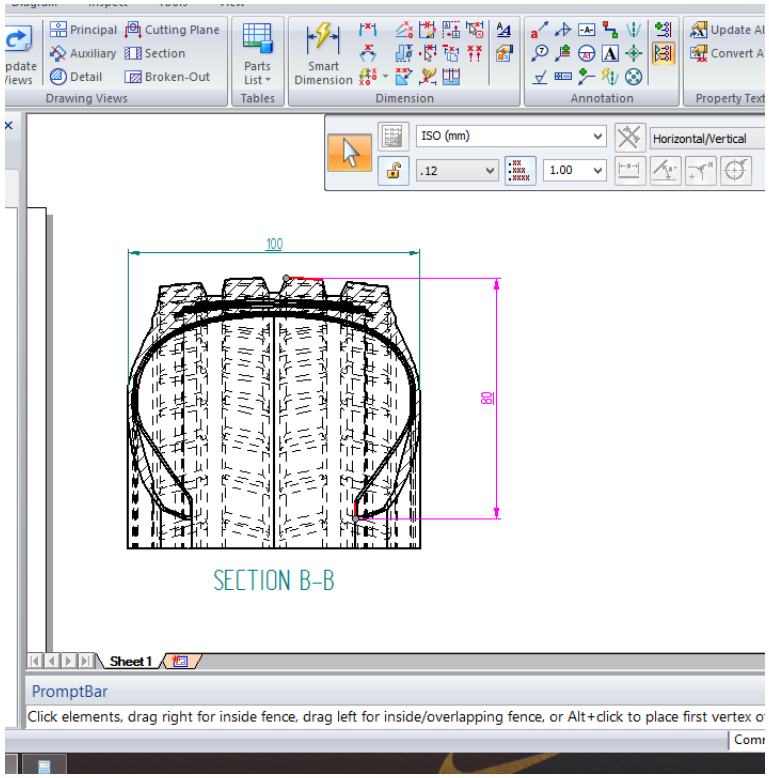
Inspect
Tools
ANSYS 15.0
View
Paste
Select
Sketch
3D Sketch
Insert Component
Create Part In-Place
Assemble
Move on Select
Drag Component
Replace Part
Motors
Face Relate
Pattern
default,Solid Edge
Switch Windows
Clipboard
Select
Sketch
Assemble
Modify
Configurations
Window
cut_tyre.asm
Coordinate Systems
Reference Planes
bead.par:1
bead_chaffer.par:1
radial_plies.par:1
black.par:1
steel plies_b.par:1
steel plies_t.par:1
cap plies.par:1
No top level part selected.
Parts Library
Learn Solid Edge
PromptBar
Select components to edit or click the Insert Component command, Create Part In-Place command, Parts Library tab or drag components from Windows Explorer.
0 items are selected
Command Finder
3:00 AM

….rendered models in KeyShot





....tire model dimensions



P 100/80 R4 70 L

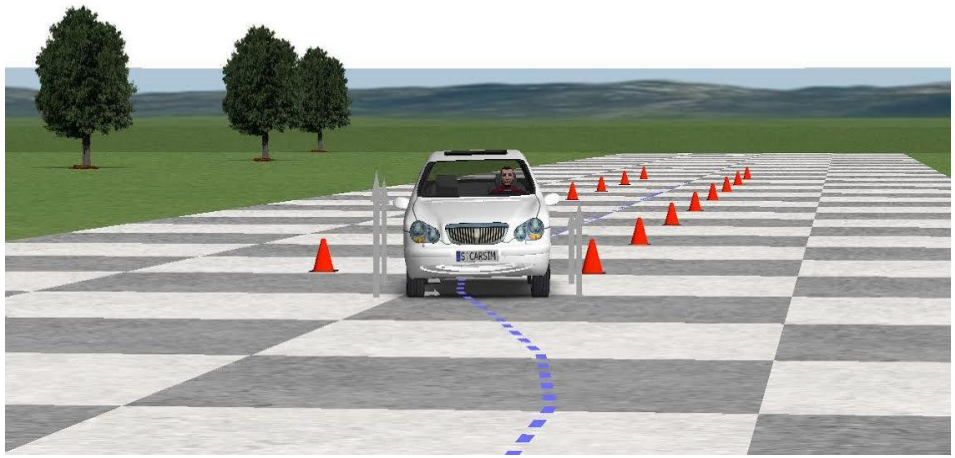
OBJECTIVES

To simulate and analyse different tire parameters using CarSim_8.1 and Adams-Car softwares in the following cases :

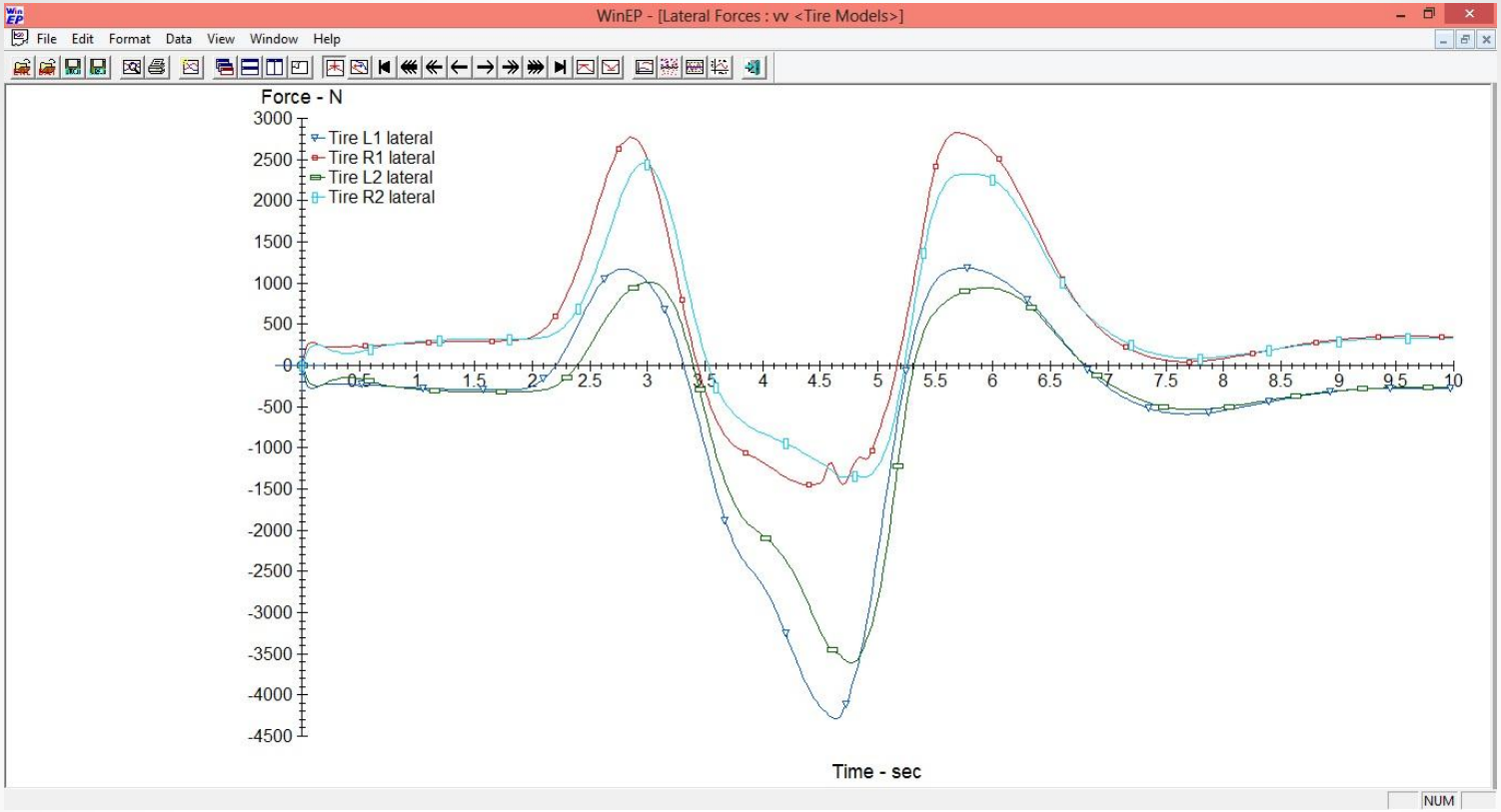
- Double lane change maneuver(CarSim_8.1)
- Fish – hook maneuver (CarSim_8.1 & Adams-Car)

Double lane change maneuver

The lane-change test is used to evaluate the handling performance of a vehicle and is an integral part of the vehicle design procedures and vehicle assessment.



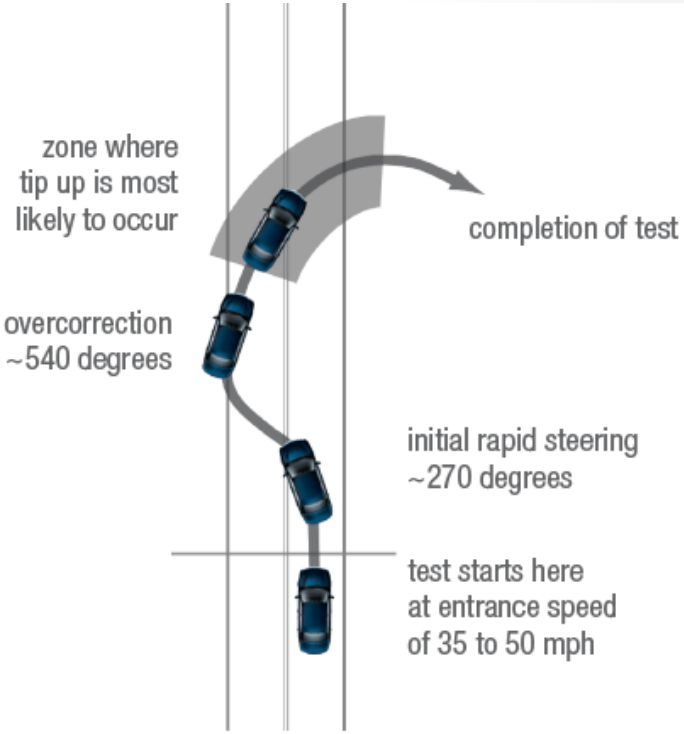
Car model : E-class sedan



- Car speed: 50 km/hr
- the maximum lateral force generated is due to increasing of slip angle during the maneuver.

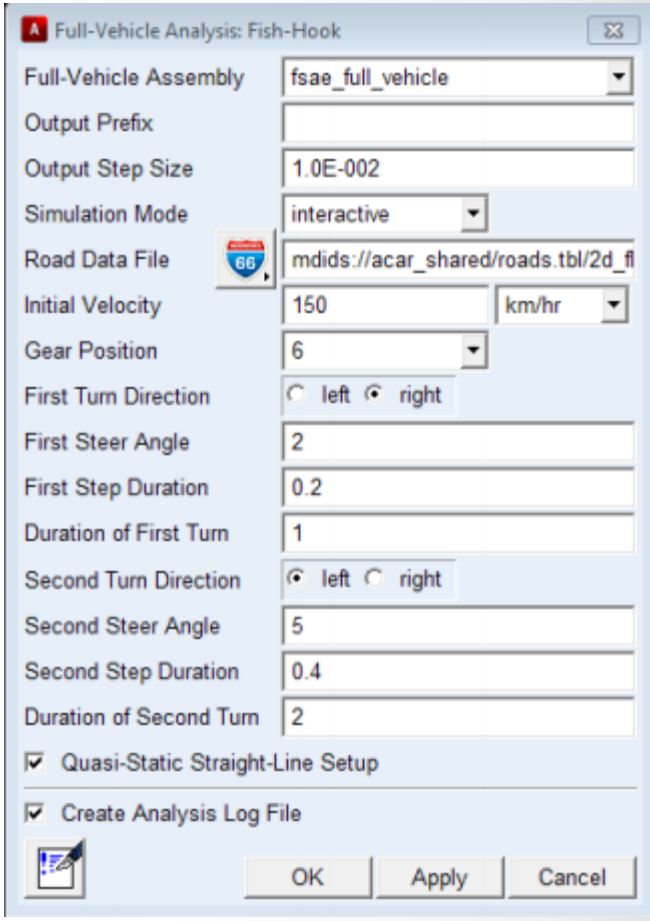
Fish hook maneuver (Adams Car)

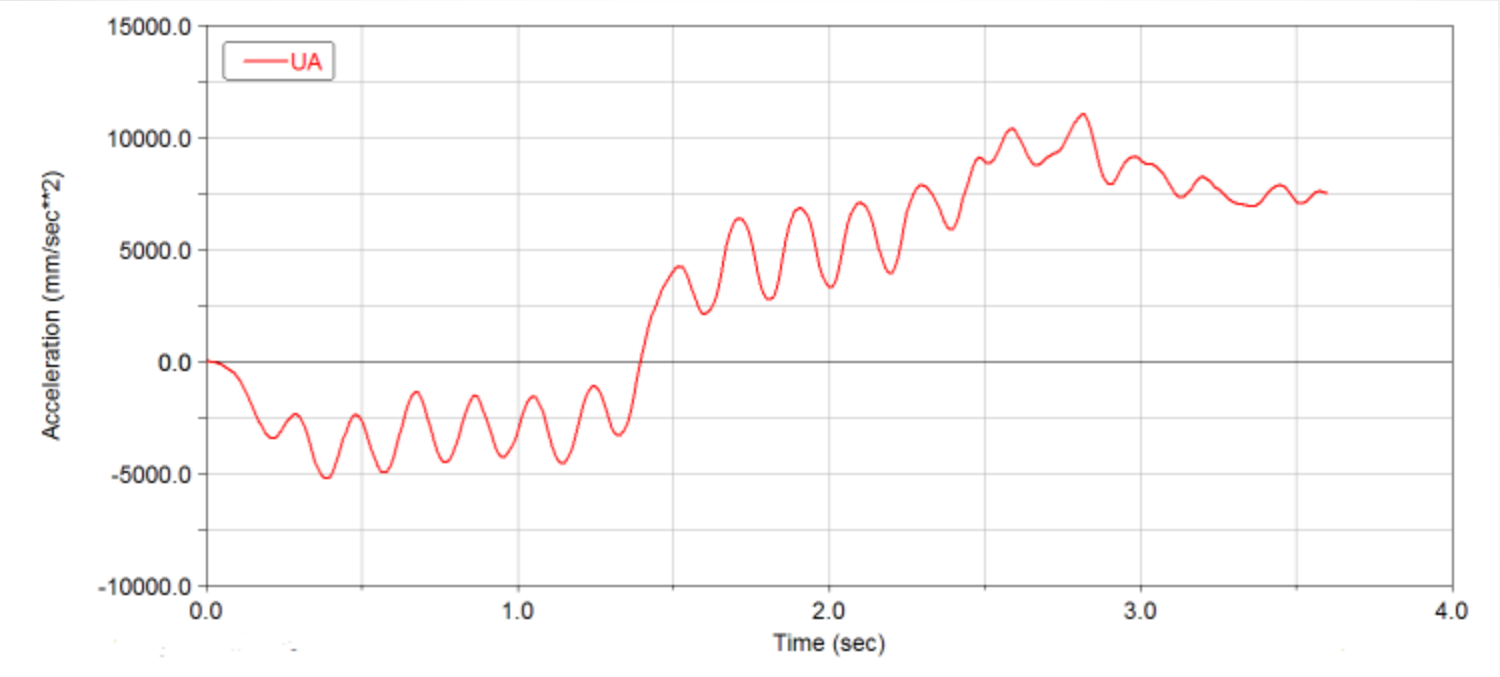
The Fishhook test involves a rapid steer input to a pre-defined angle, a dwell period until the roll-rate of the vehicle reaches a pre-defined trigger point corresponding to maximum roll of the vehicle, at which point a rapid steer input is made in the reverse direction.



- Initial velocity: 150 km/hr
- Gear position : 6

- The vehicle is first made to steer to right (2 degrees) and then to the left side(5 degrees)

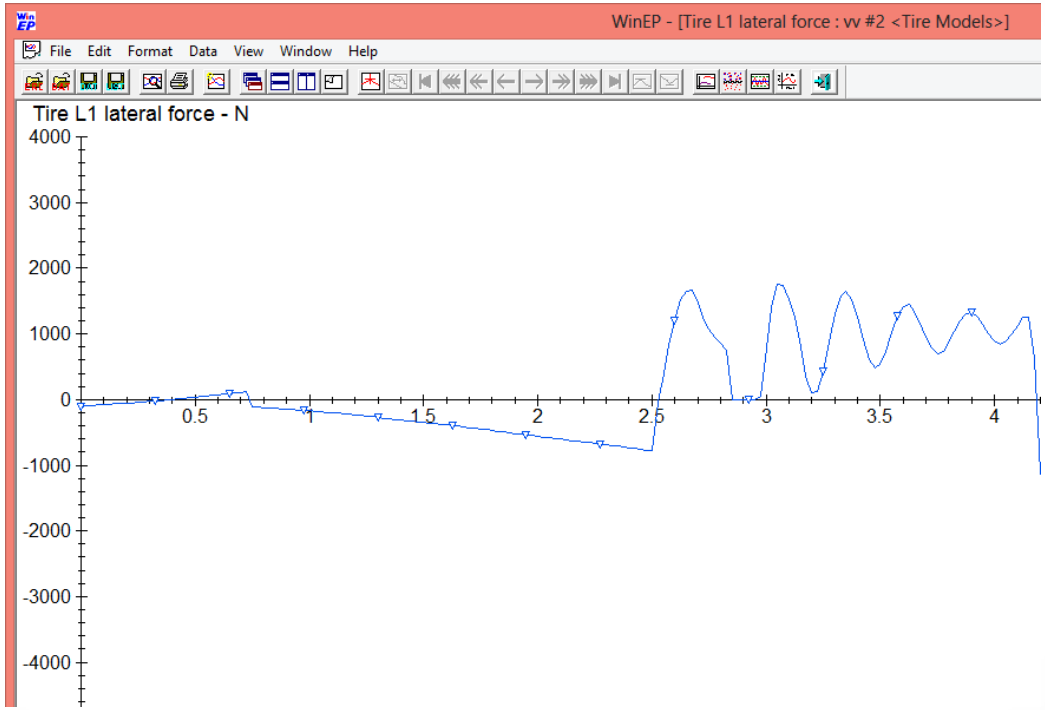




- UA tire model is used.
- We got negative lateral acceleration upto 1.4 sec (to right side) and then it turns positive.
- The oscillations may be due to the lateral tire slip at high speed turning.

Fish hook maneuver (CarSim_8.1)

- Drive speed : 80 km/hr



- The test results in AdamsCar and CarSim gave comparable results.

CONCLUSION

- The full car model and tire models are made using Solid Edge ST7.
- Double lane change test is carried out in CarSim to analyse the tire performance.
- Fish hook maneuver test is carried out both in AdamsCar and CarSim and the results are found to be comparable.

REFERENCES

- MSC Software. Adams 2012.1.3. Computer Program. MSC Software, 2012.
- CarSim_8.1 software. Mechanical simulation, 2011.
- Modeling and Validation of Magic Formula Tire Model , Mohammad Safwan Burhaumudin, Pakharuddin Mohd Samin,2012.
- CarSim quick start guide .
- Adams tutorials: http://web.mscsoftware.com/Academia/Learn/Learn-AdamsCar.aspx

THANK YOU ☺