IITI SOC
(Design and Modelling)

PS 1: Design, Finite Element Analysis and Optimization of an Automotive Suspension System using Python

Team Details:

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Why We Chose. . . . . .??

Double Wishbone Suspension

- Improved Handling and Stability
- Camber Control
- Independent Wheel Movement
- Customization and Tuning
- Adjustability

Push Rod Mechanism

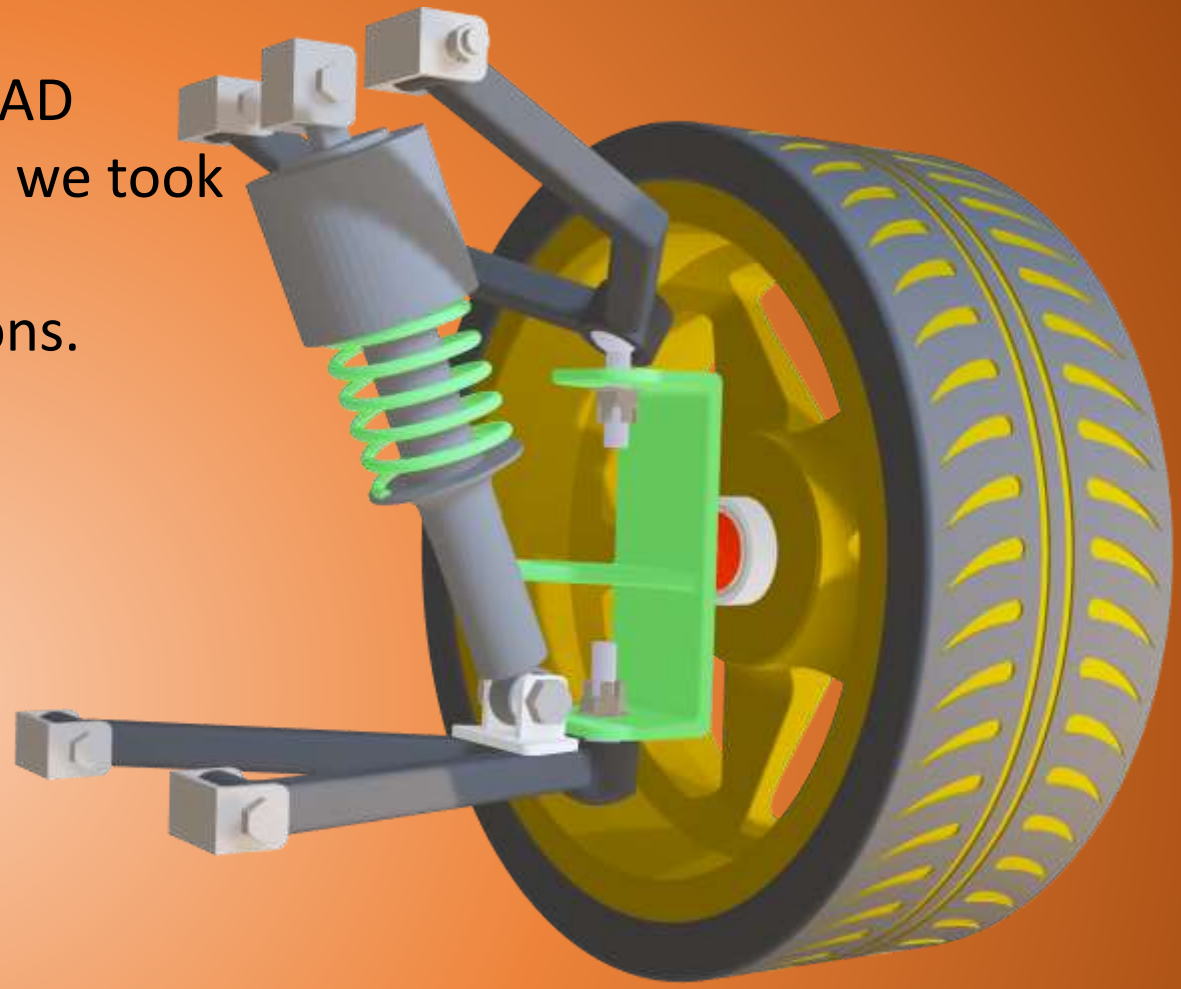
- Enhanced Suspension Tuning
- Improved Weight Distribution
- Lesser Unsprung Weight
- Enhanced Performance

REFERNCE DESIGN

INITIAL DESIGN

FINAL DESIGN

This is reference CAD model from which we took inspiration and estimate dimensions.



It was our rough idea of design because This model did not match with the actual design of suspension system, which thing we rectified in our model.

REFERNCE DESIGN

INITIAL DESIGN

FINAL DESIGN

COMPLETE SUSENSION

This is our design having approximate dimension as of reference design including knuckle connecting links and piston of suspension.

In this design, we found some errors such as knuckle was thin, and some problem in ball joint was there.

INITIAL DESIGN

FINAL DESIGN

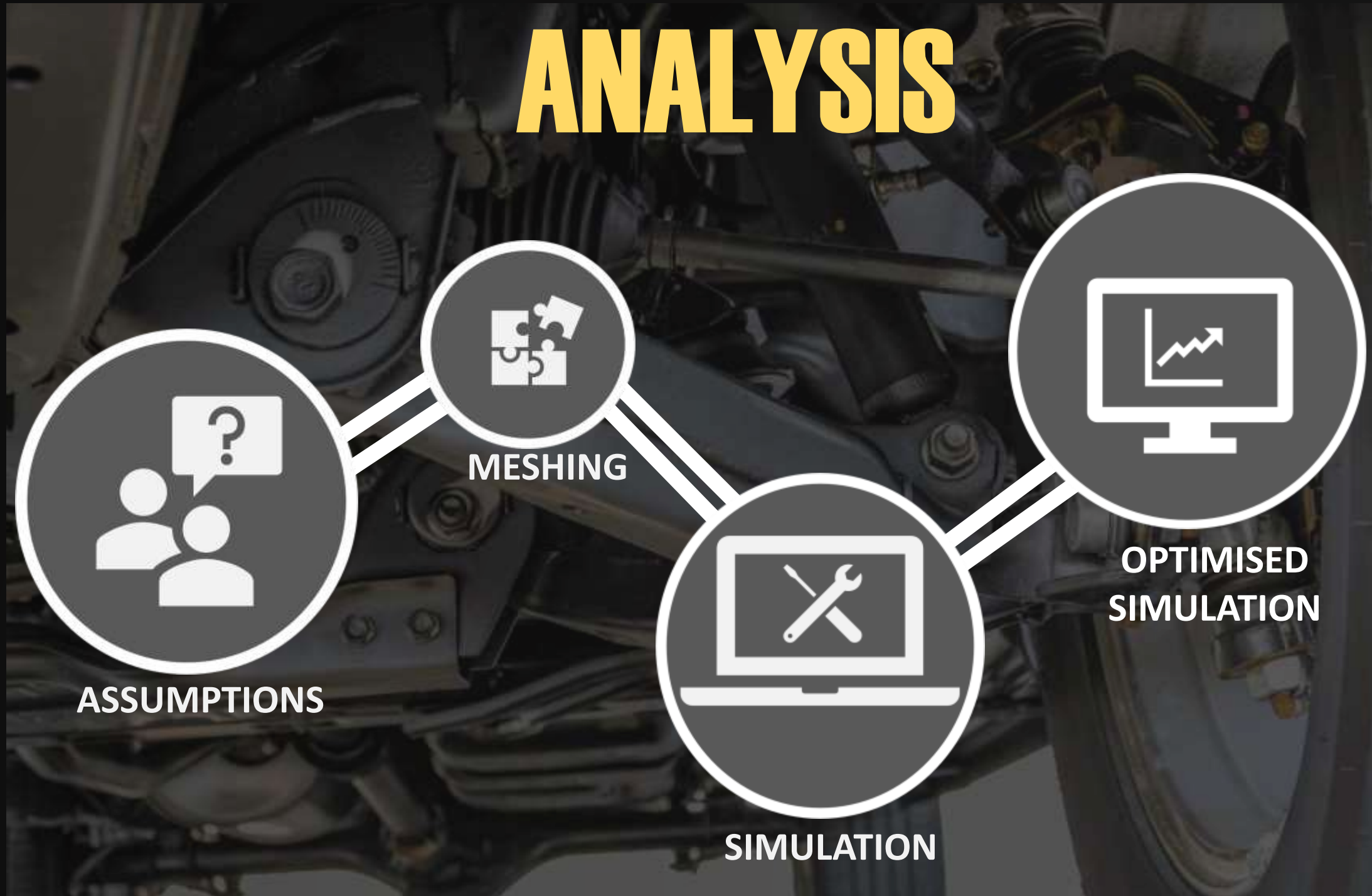
COMPLETE SUSENSION

In this, we replaced simple coilover damper suspension with push rod mechanism after conversation with mentors.

FINAL DESIGN

COMPLETE SUSENSION

ANALYSIS

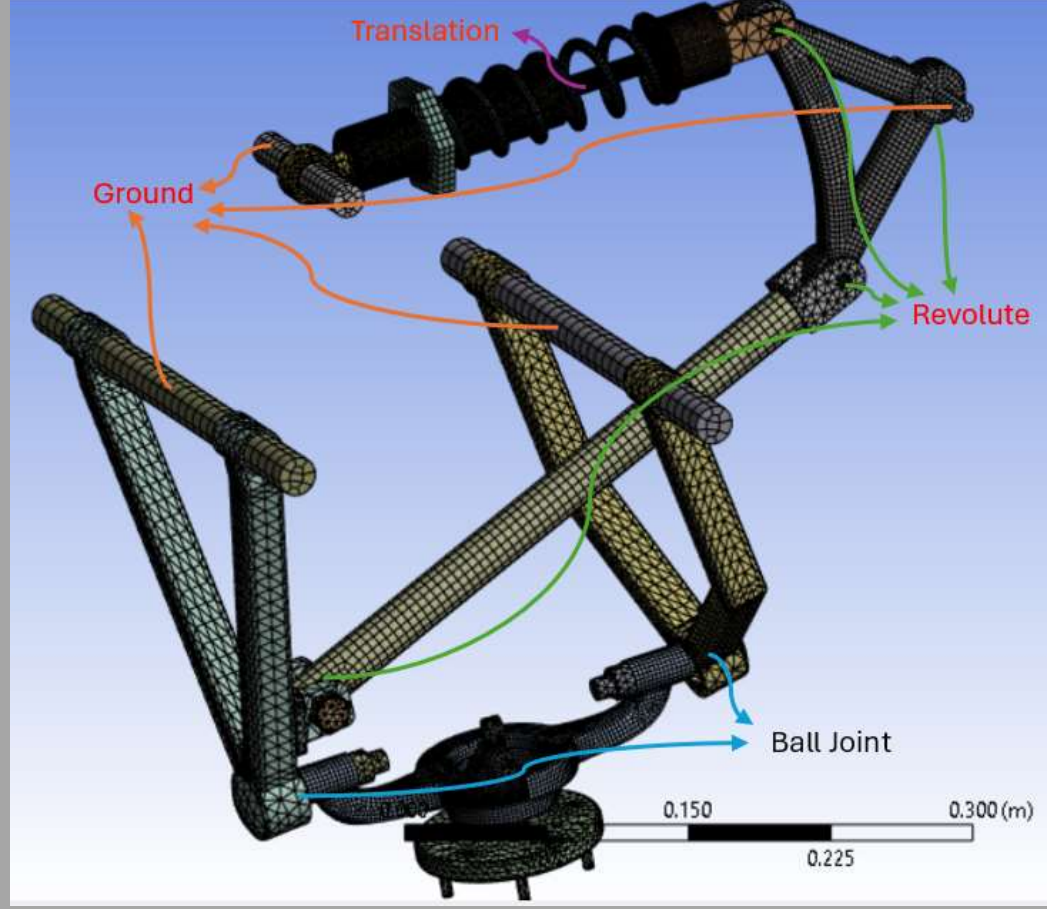


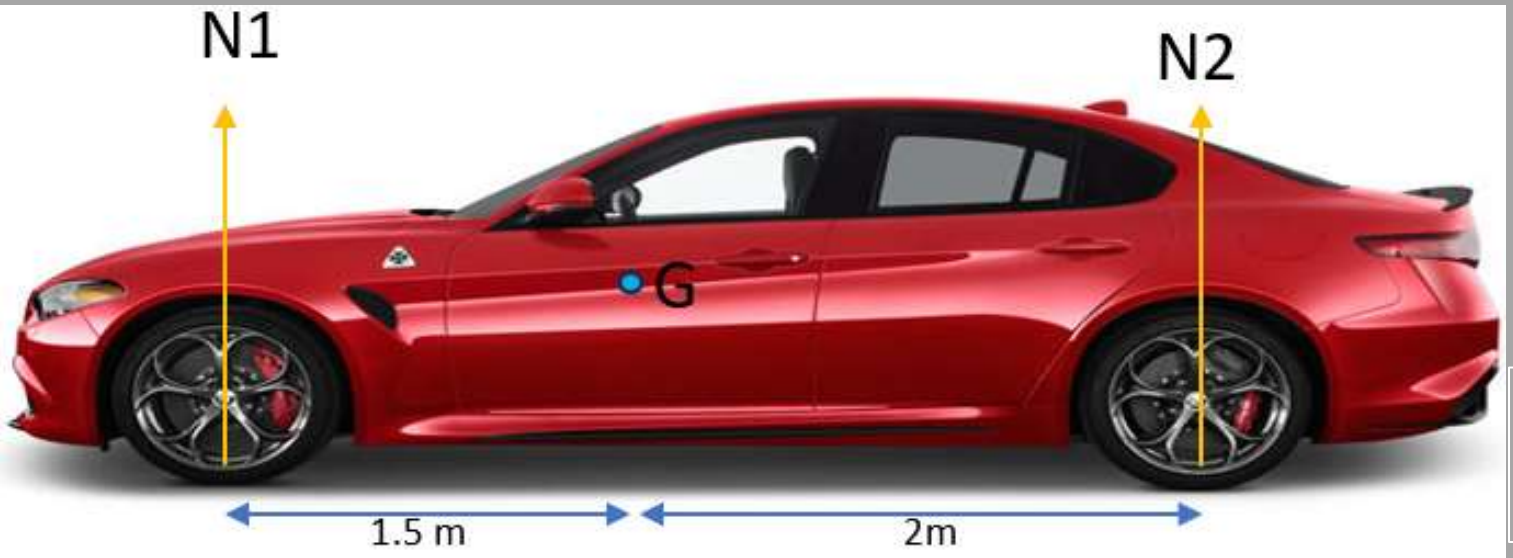
❑ ASSUMPTIONS:

Model is assumed to be static and linear.
Joints are assumed to be frictionless.

Mass of car (Alfa Romeo Giulia)= 1400 kg

❑ *JOINTS*





❑ *FBD OF CAR*

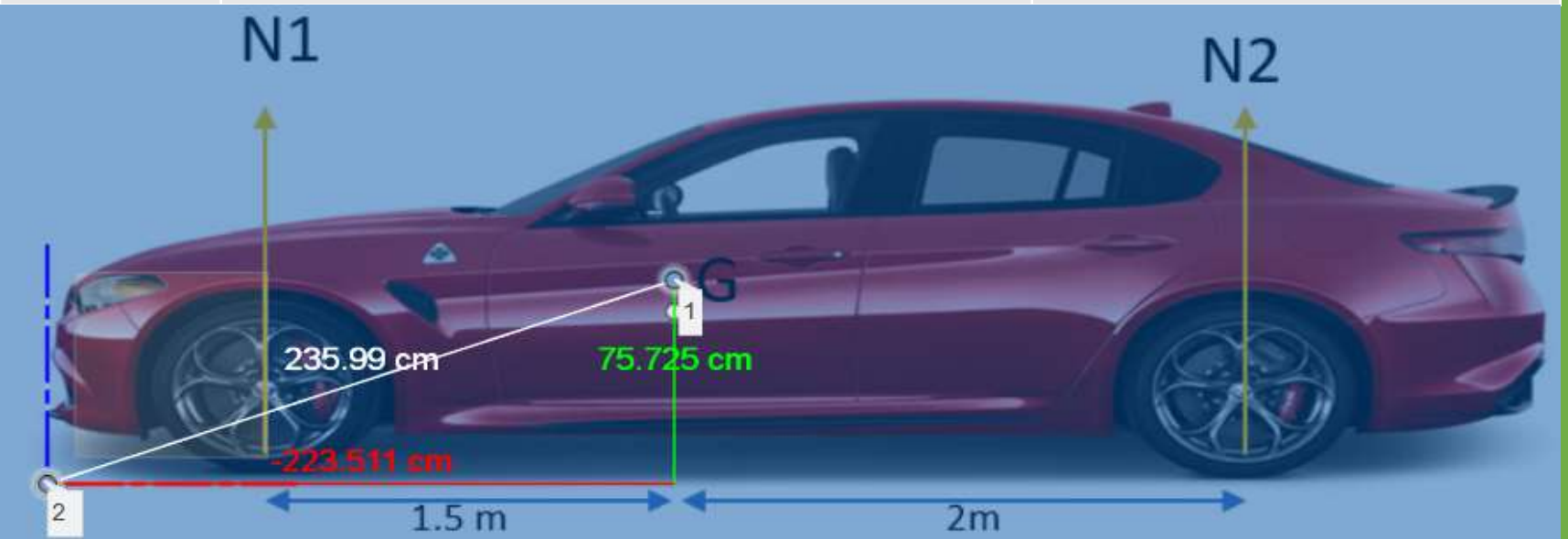
Point G is COG

Forces :

N1= 4000 N

N2=3000 N

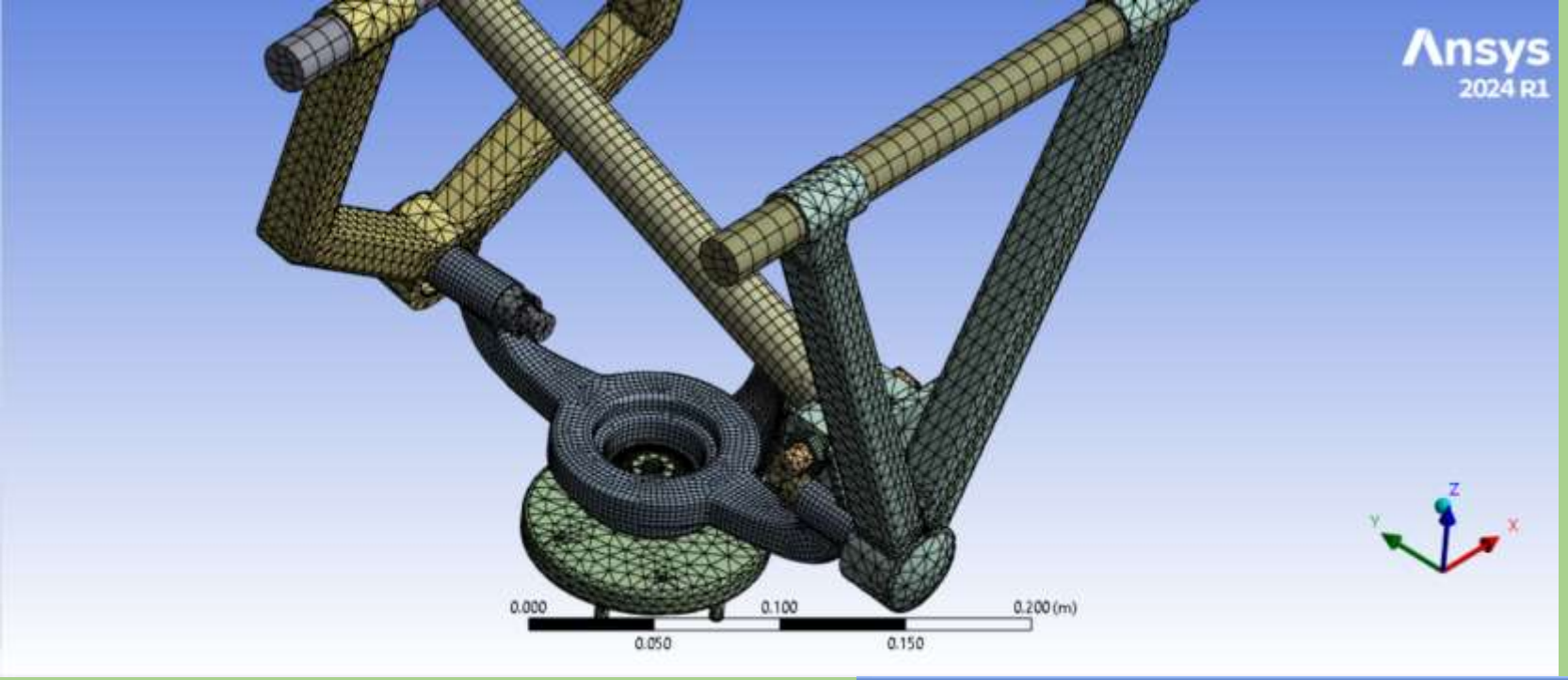
Sr. No.	Property	
1.	Vehicle Mass	1400 kg
2.	Mass Distribution	4:3
3.	Front Track	1.5 m
4.	Rear Track	1.8 m
5.	Center of Gravity(x ,y)	(2.23m, 0.75m)
6.	Vehicle Width	1.8 meters
7.	Vehicle Height	1.4 meters
8.	Total Vehicle Length	4.14 meters
9.	Wheel Base	3.5 meters



Material	Component
Aermet-100	1.Nut Bold 2.Spring 3.Push Rod 4.Lower A-Arm Bracket
Low Alloy Steel-4140	1.Knuckle 2. A-Arm 3.Damper 4.Rods

❑ Materials Used

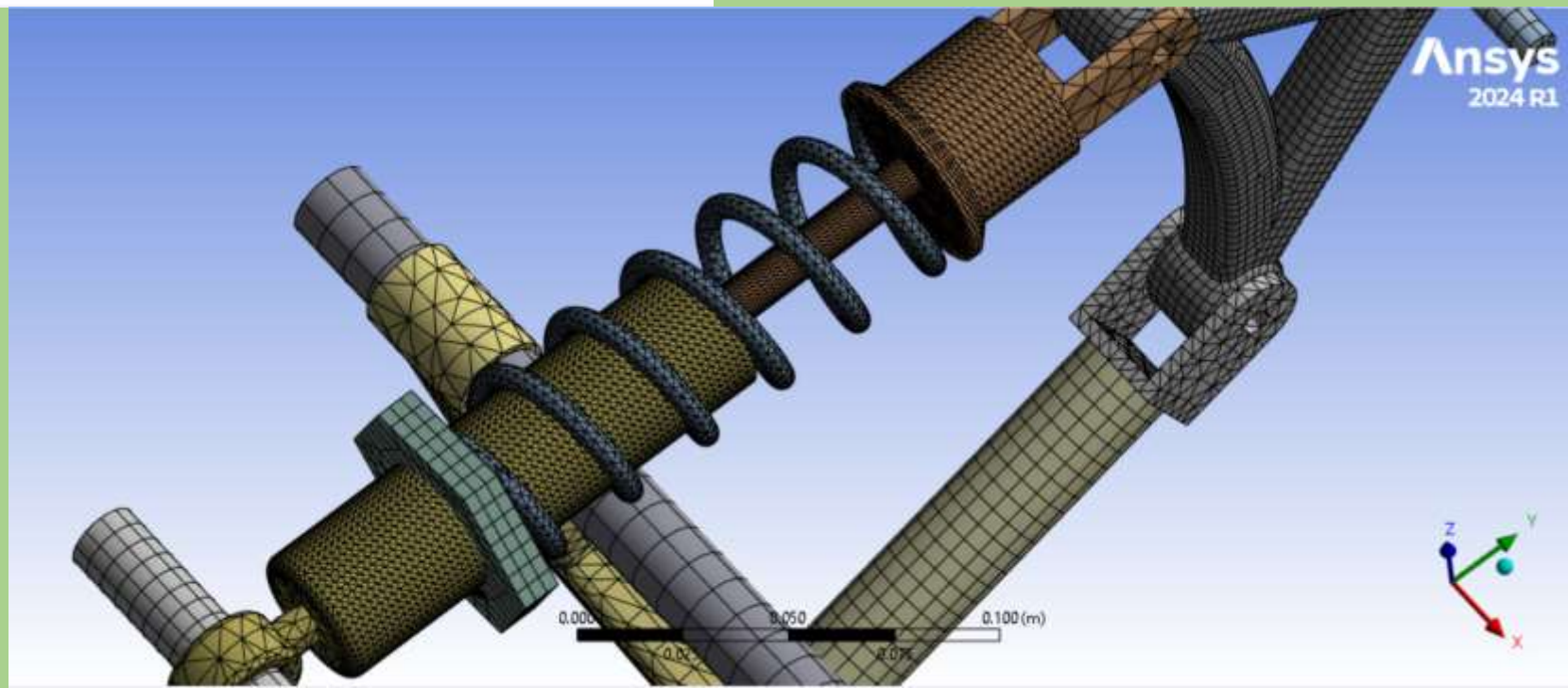
➢ Centre of Gravity



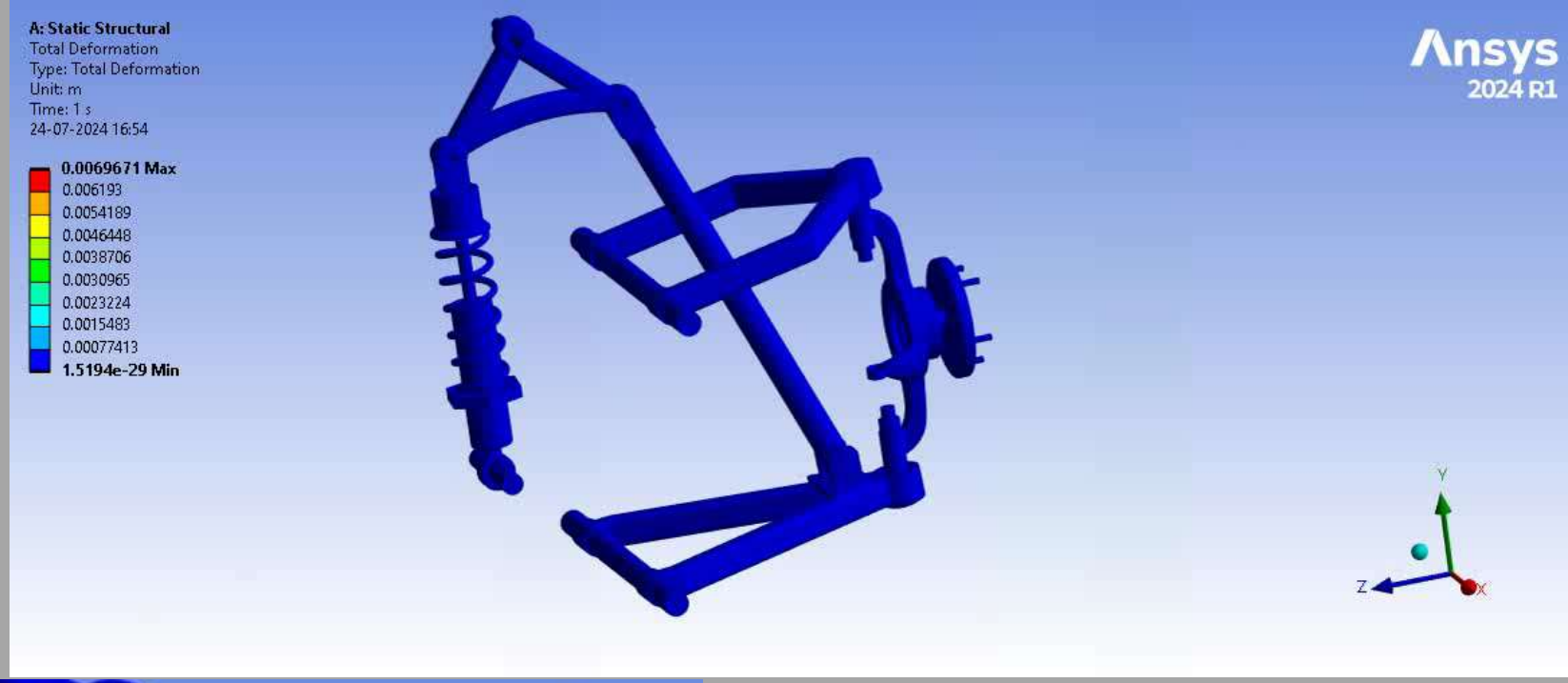
NO. OF ELEMENTS= 1,57,584
NO. OF NODES=3,48,870

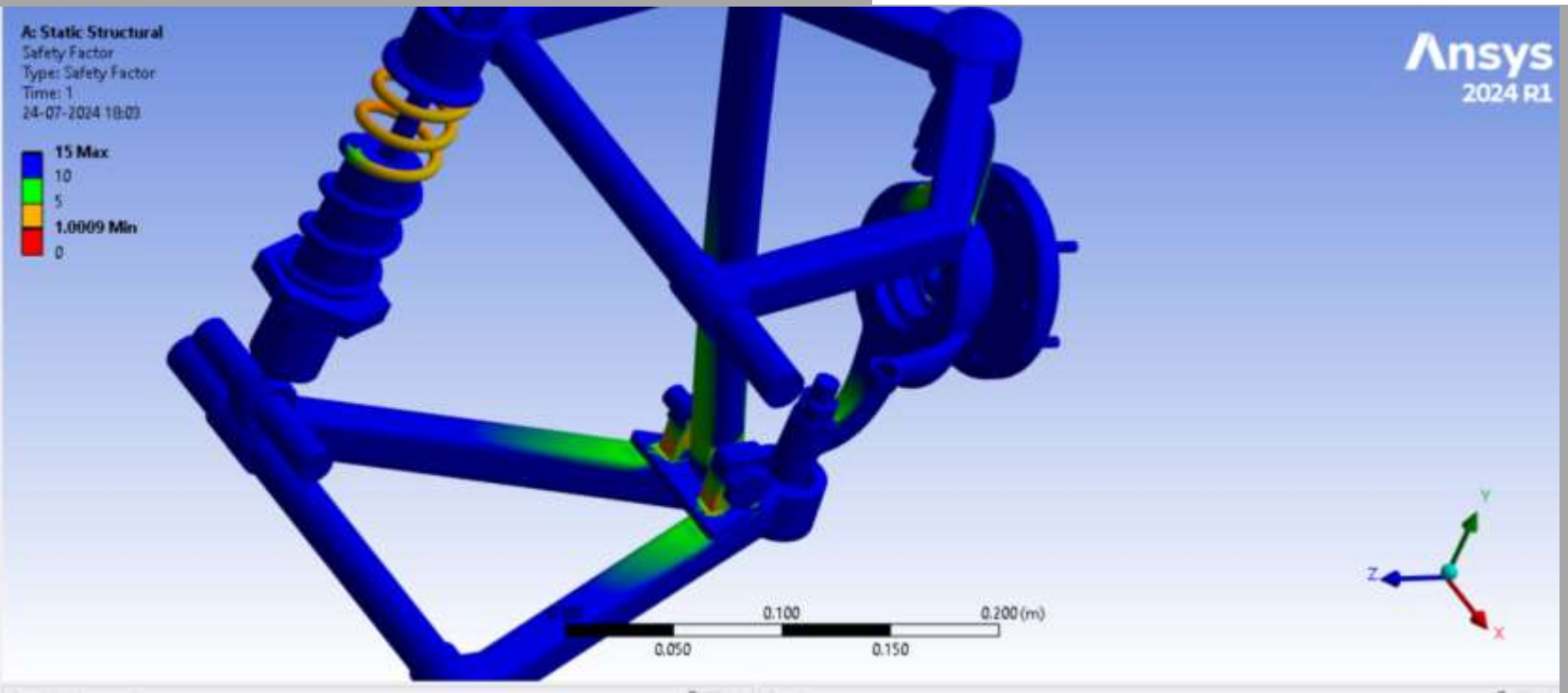
Why we chose hexadominant (quadrilateral) Meshing?

- ❑ Accuracy and Convergence
- ❑ element Quality
- ❑ Mesh Density and Size
- ❑ Solver Efficiency

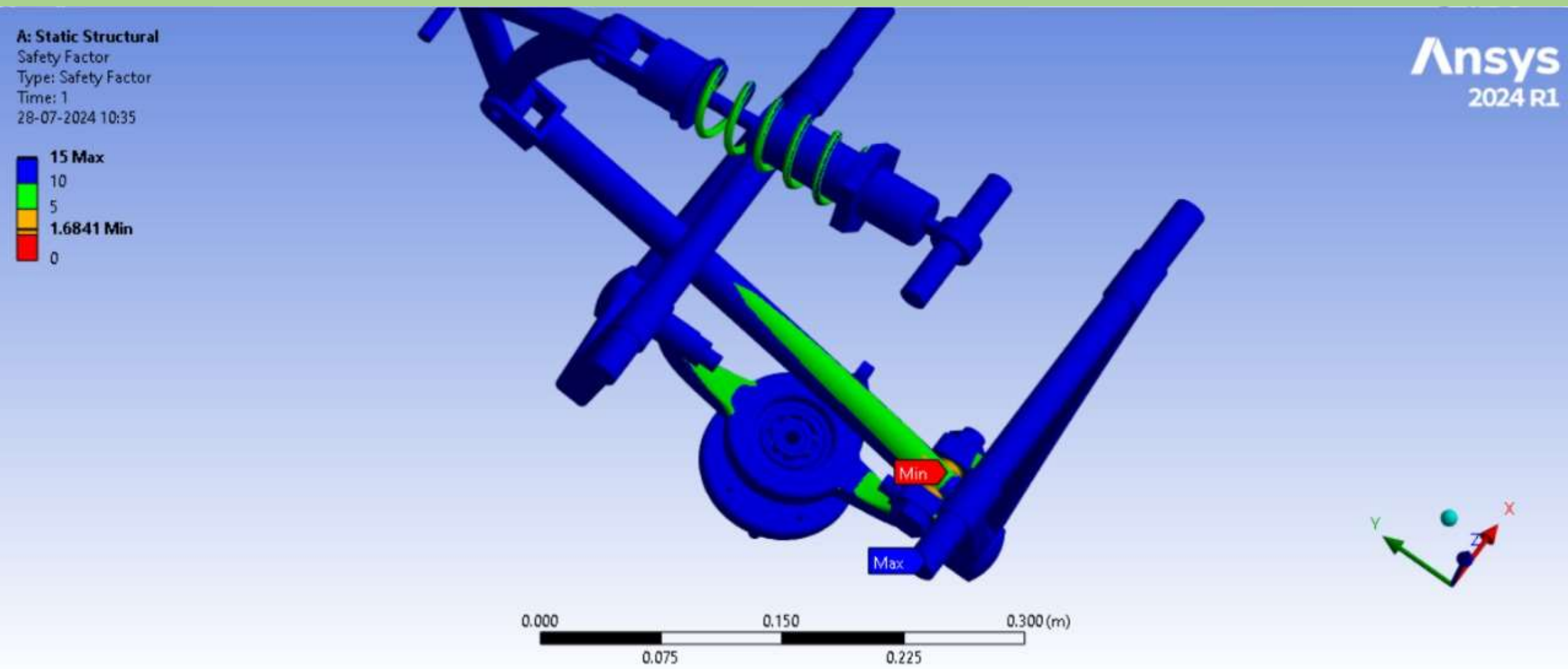


Deformation(Max.)= 6.97 mm





Factor of Safety(Min.)= 1.0009



To Increase the Factor of Safety, Material of Lower-Arm Bracket changed to Aermet-100, dimensions of bracket increased by 10% and diameter of holes increased to increase the factor of safety.

As expected, FOS(min.) increased to 1.6841

REFERENCES:

Design Reference

Vehicle Dynamic Course