

MARS Rover Rocker-bogie Design

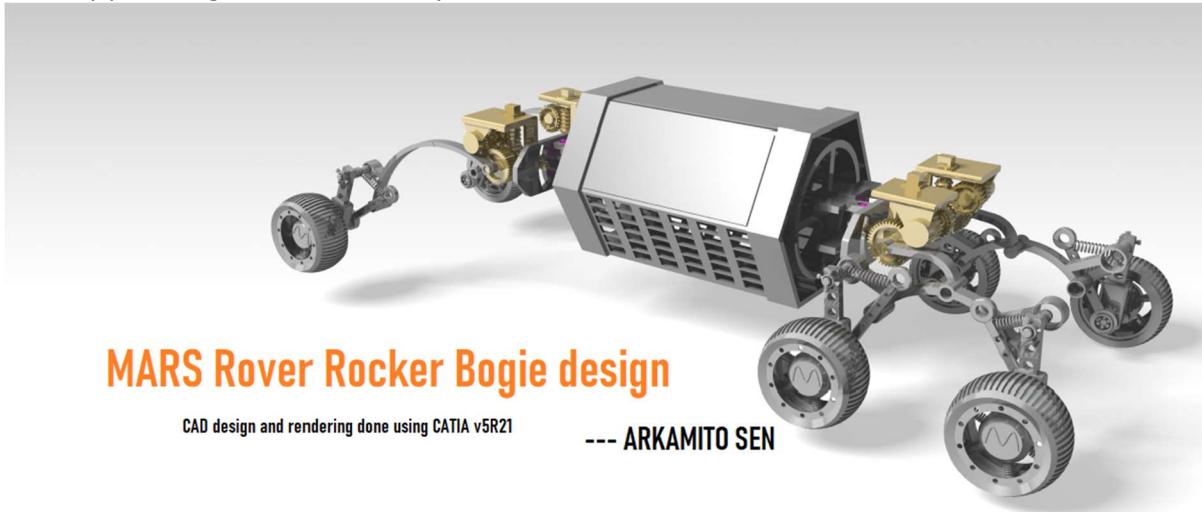
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Rocker bogie mechanism is a mechanism primarily used in the mars rovers to overcome the rough terrains while maintaining stability. It consists of two arms with wheel mounted to each. Both arms are connected through a movable joint. This enables to have a suspension-based mechanism that distributes the vehicle load as evenly as possible even on bumps and irregular surfaces. The design consists of a spring free suspension based differential drive system that allows the bogie to move over rocks, pebbles with ease. The sensors and cameras mounted on a rover must be stable to work properly and also to increase their life spam. More vibrations and jerks lead to faster wear and tear in sensors, circuit boards and cameras. The rocker bogie mechanism was designed keeping this in mind by providing maximum stability in all terrains.

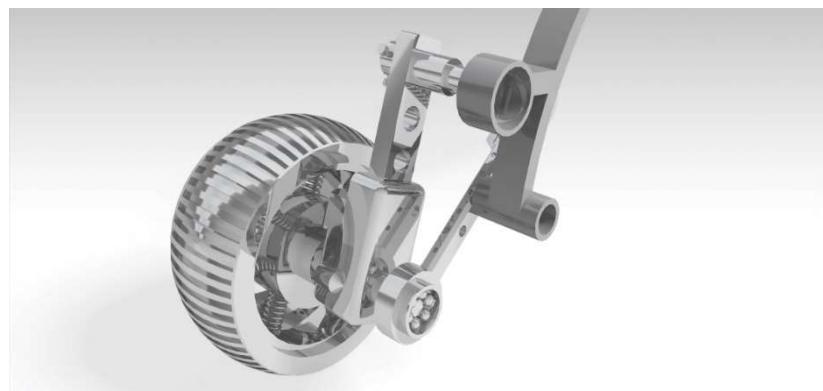


Design in Brief:

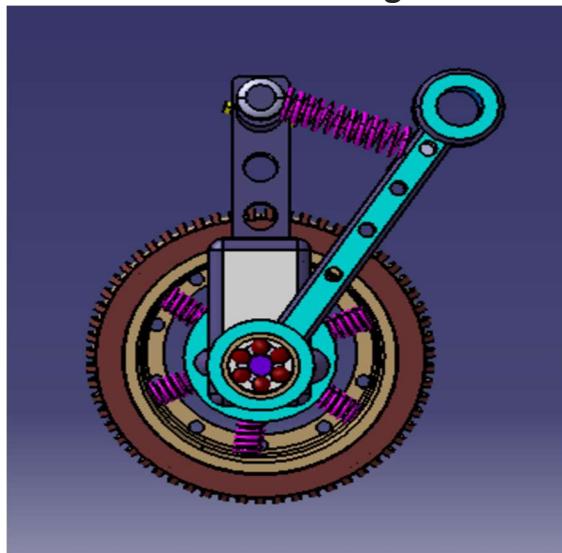
Wheel: The rover has six wheels, each with its own individual motor. The two front and two rear wheels also have individual steering motors. This steering capability allows the vehicle to turn in place, a full 360 degrees. The four-wheel steering also allows the rover to swerve and curve, making arcing turns.

(Rendered Images of Wheel and the front Leg Assembly, Catia v5)

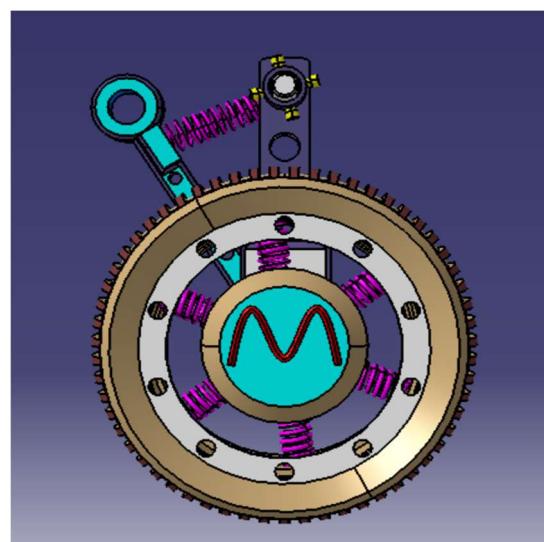




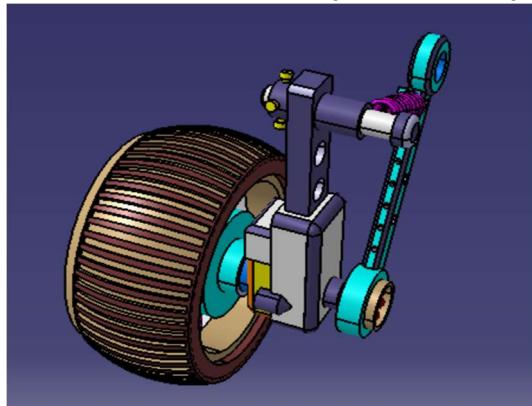
Catia v5 Wheel Part design:



(Rear view)

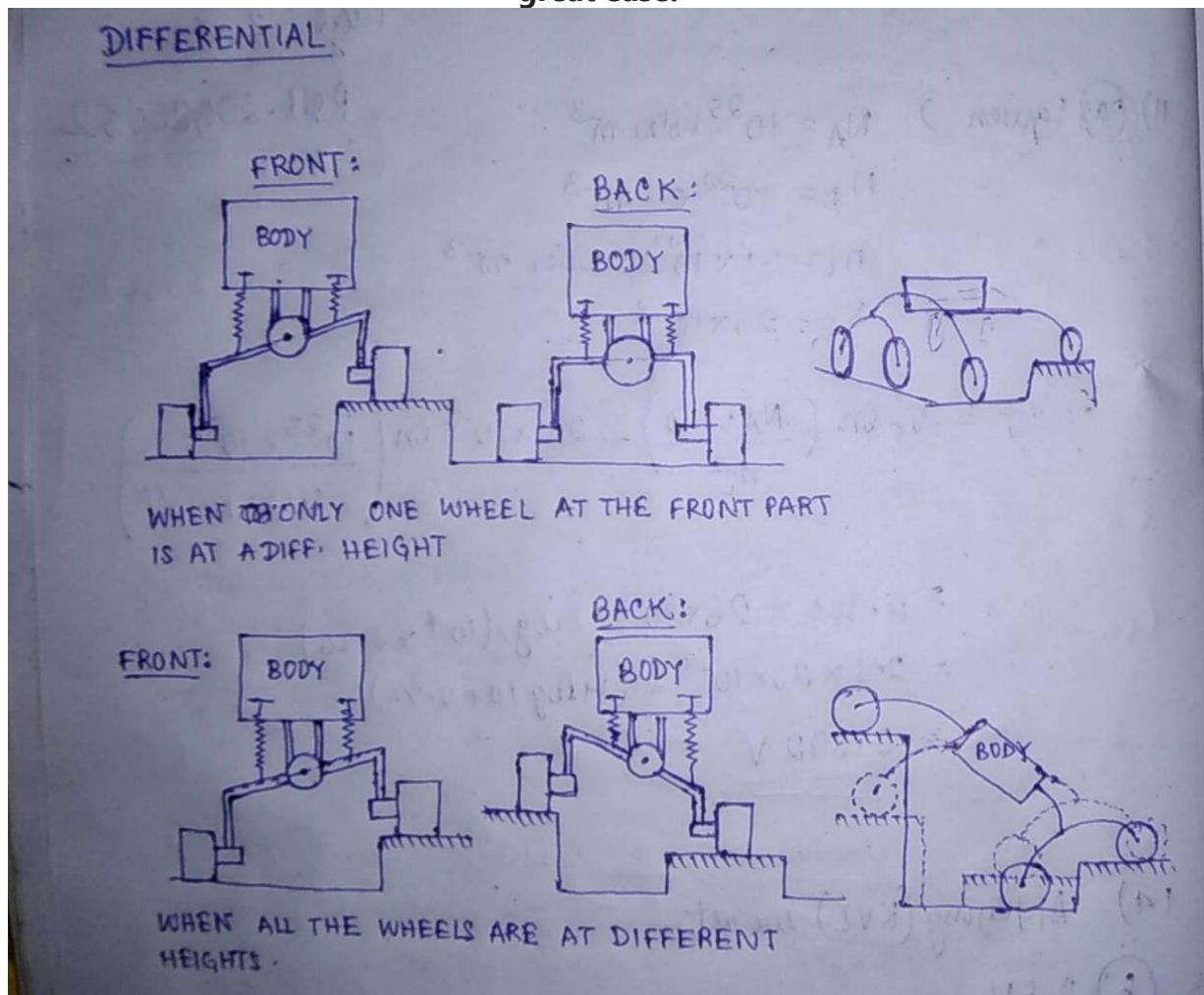


(Front View)

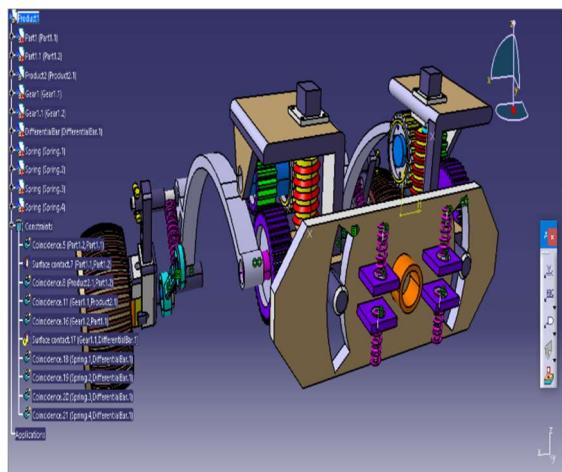
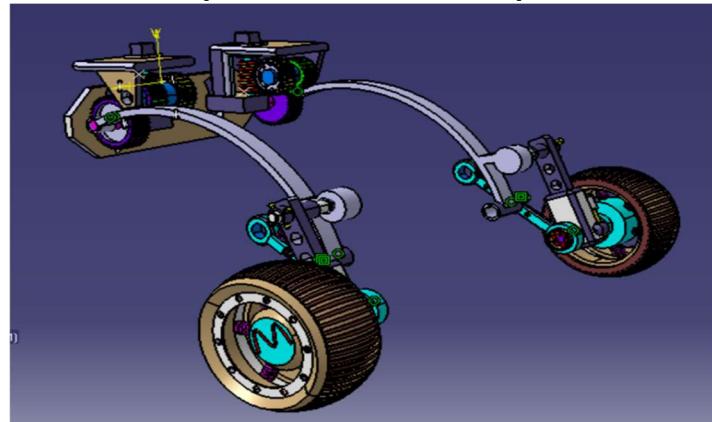


Differential: Connects to the left and right rockers and to the rover body by a pivot in the centre of the rover's top deck. The differential allows the rover to stand stable even when its legs are at different levels.

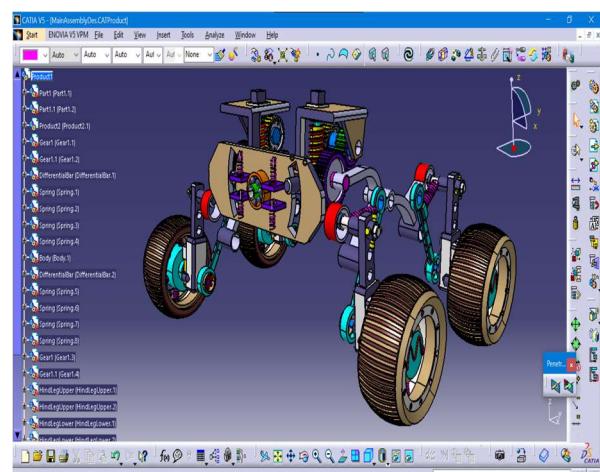
Sketch showing how the differential will help the rover to make all the wheel touch the ground thus increasing stability, even after the ground being rugged with steep ups and downs. Thus enabling the rover to move in all terrains with great ease.



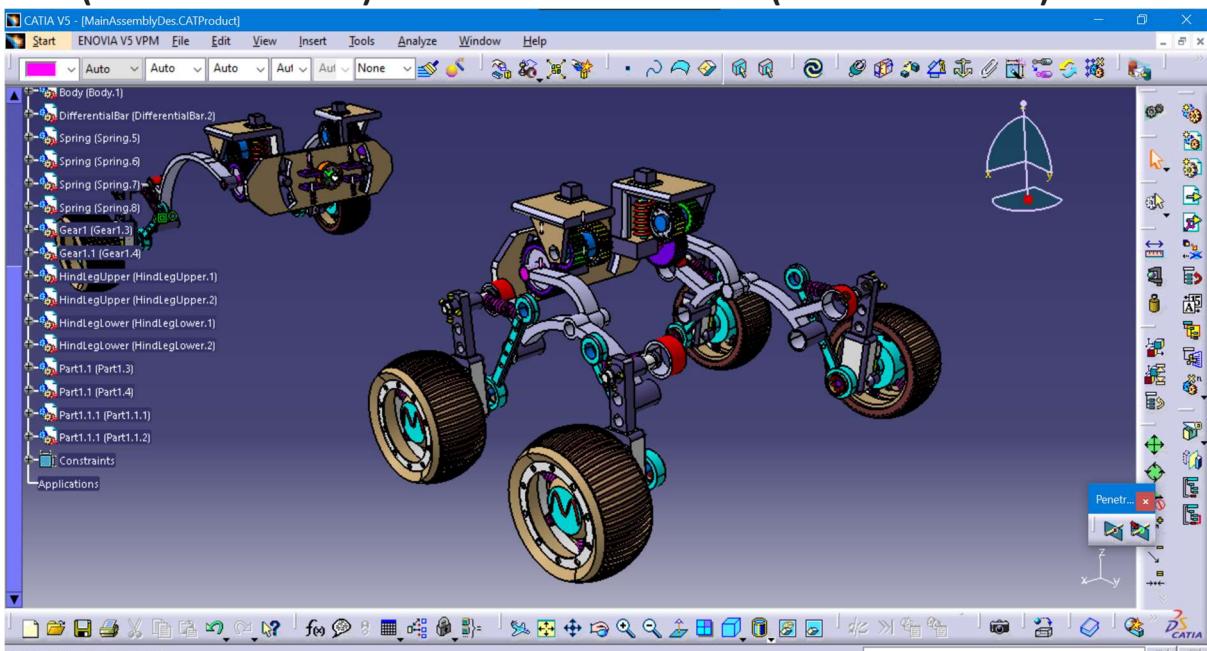
(front Isometric View)



(Front Differential)



(Rear Differential)



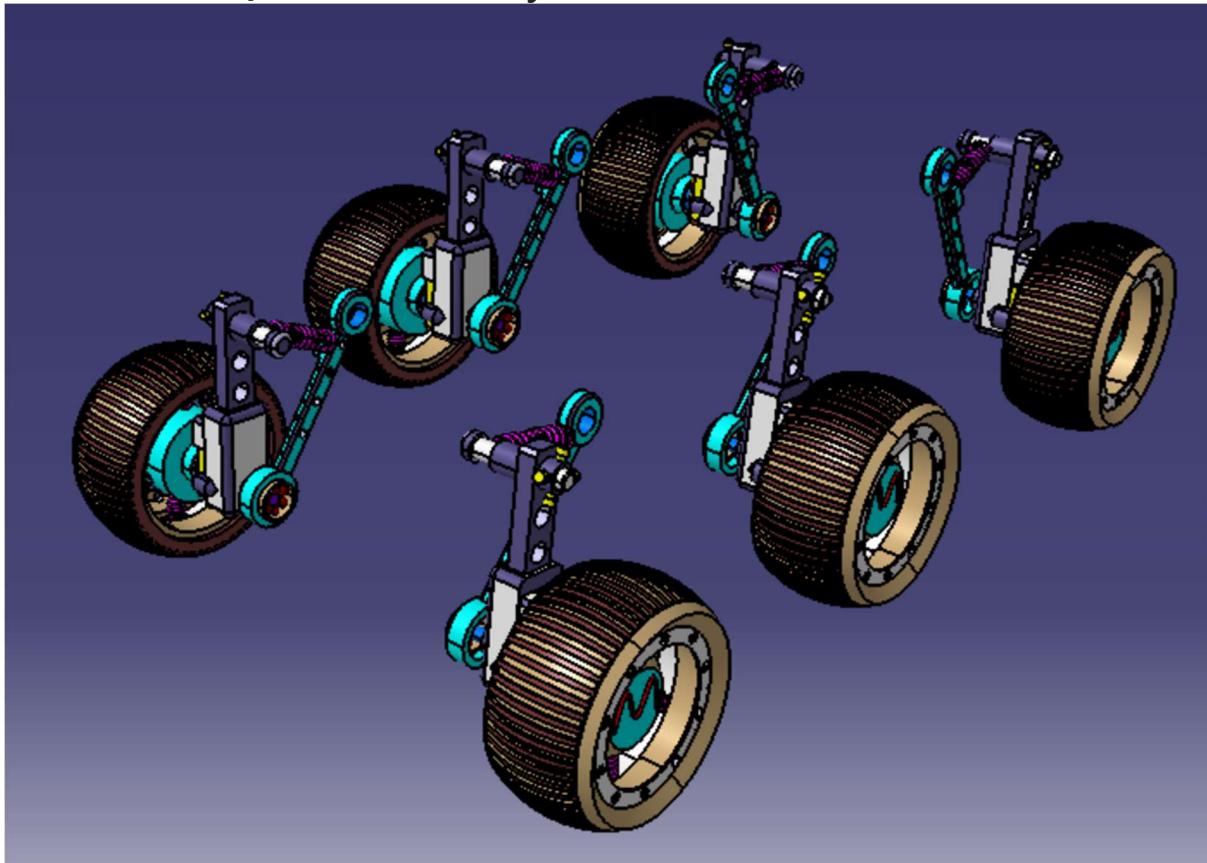
(Catia v5 , Assembly Model of Differential, Wheel, Legs, Gearbox)

Rocker: One each on the left and right side of the rover. Connects the front wheel to the front differential and the bogie in the rear.

Bogie: Connects the middle and rear wheels to the rear differential.

The six-wheel drive allows the rover to overcome larger obstacles with better tilt stability and also allows the rover to keep all of their six wheels on the ground at all times increasing stability.

(Catia v5 , Assembly Model of the 6-wheel drive)

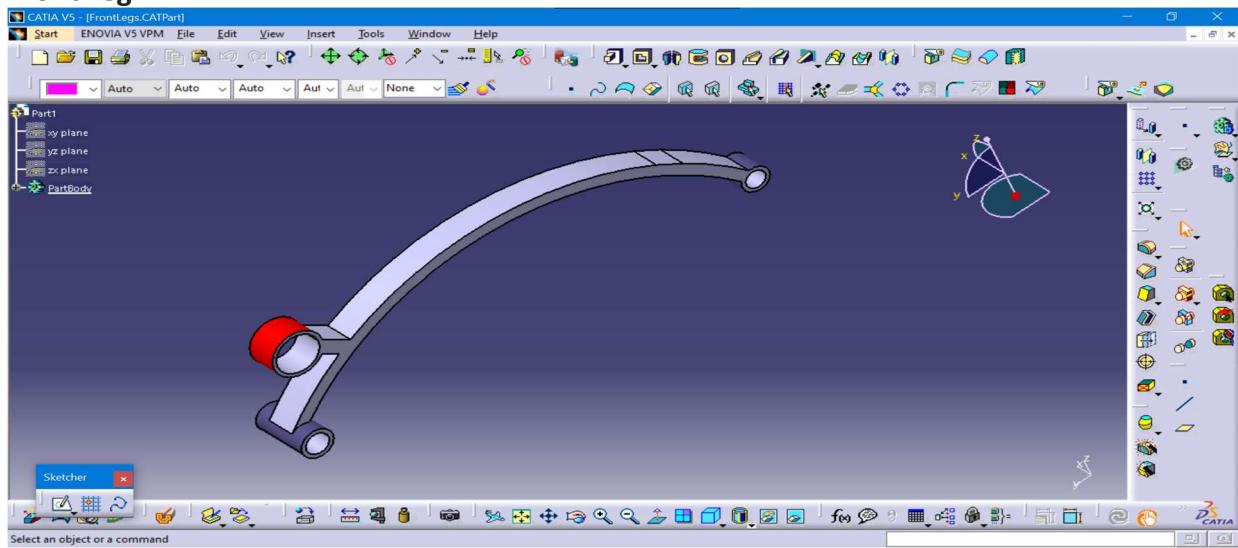


The widespread legs help to increase the stability of the Rover. The long front legs increase the reach of the vehicle. The curved leg framework provides better and stronger support than normal straight legs. It also increases the reach of the legs, providing better support to the body.

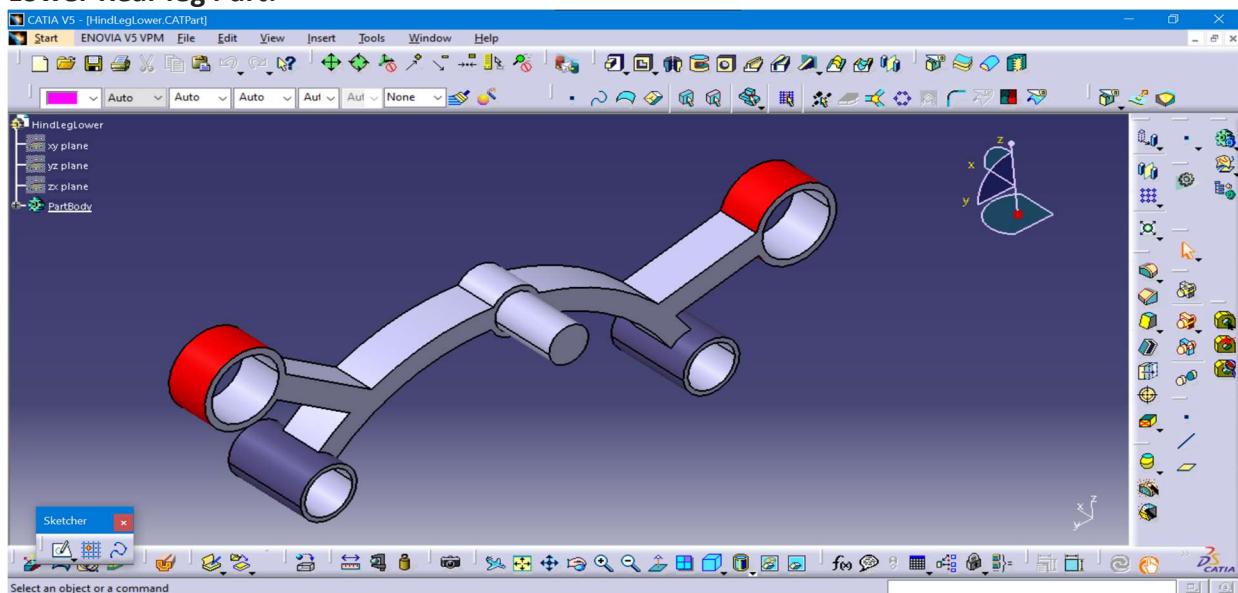
Front and Rear Legs:

The curved leg, increases the load bearing strength of the framework.

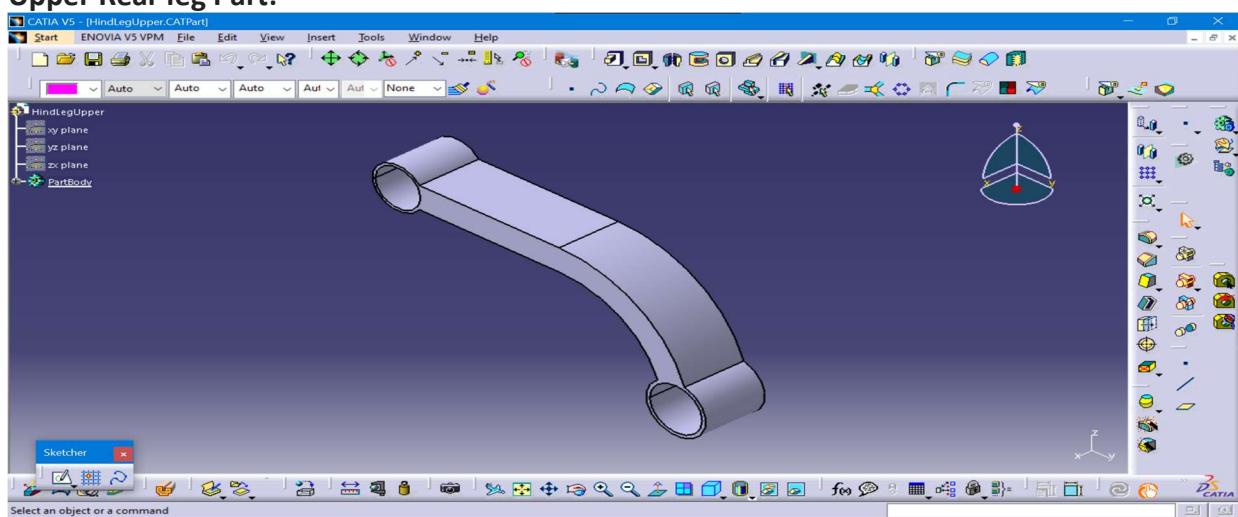
Front Leg:



Lower Rear leg Part:

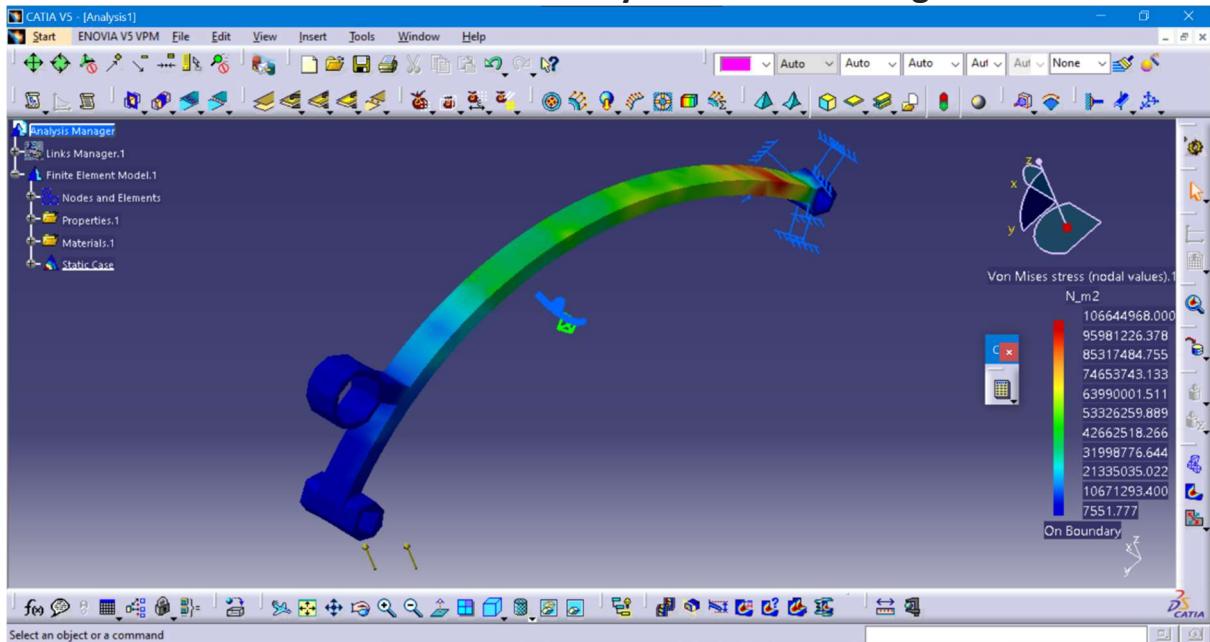


Upper Rear leg Part:

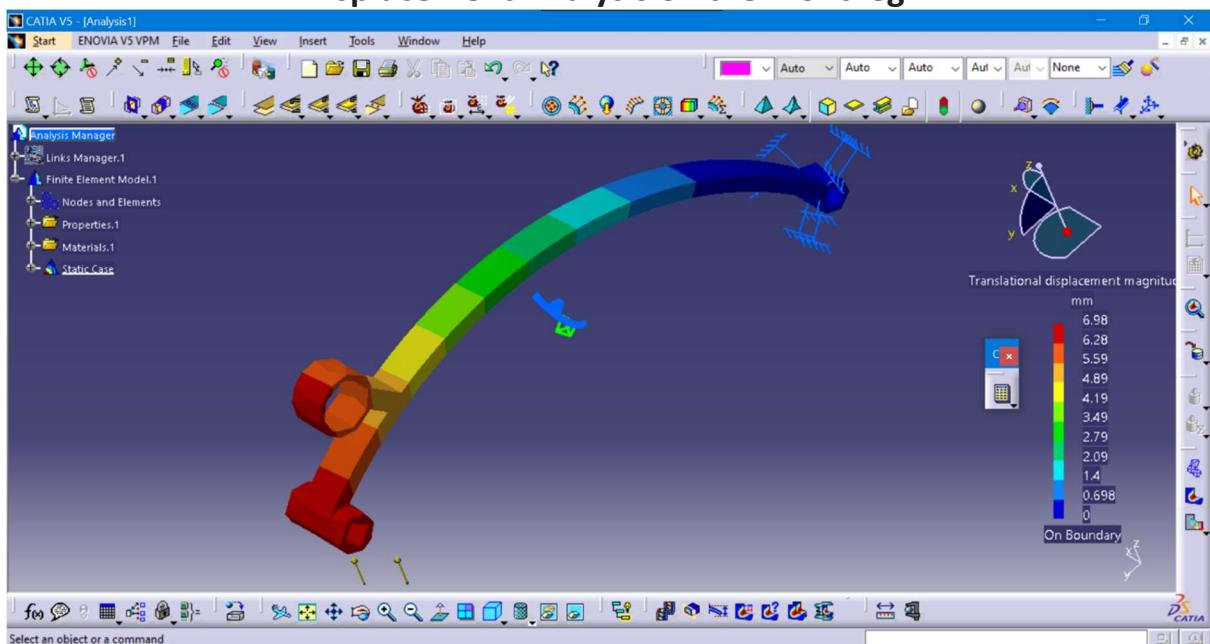


Stress Analysis using Catia v5:

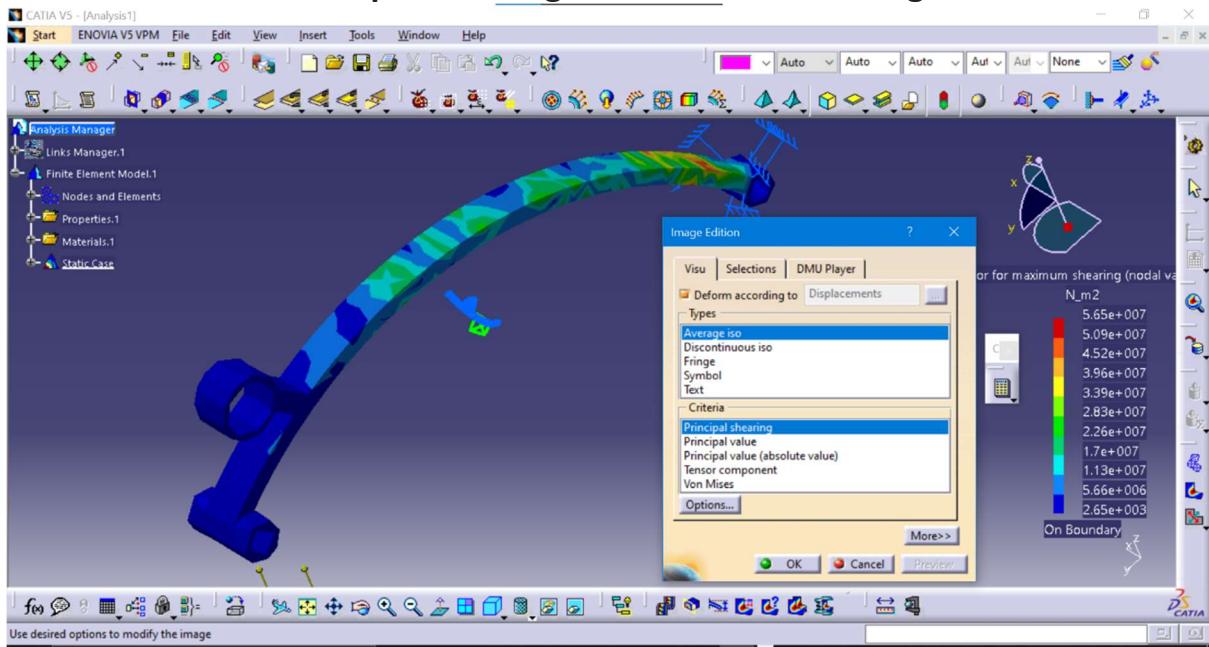
Von Mises Stress Analysis on the Front leg:



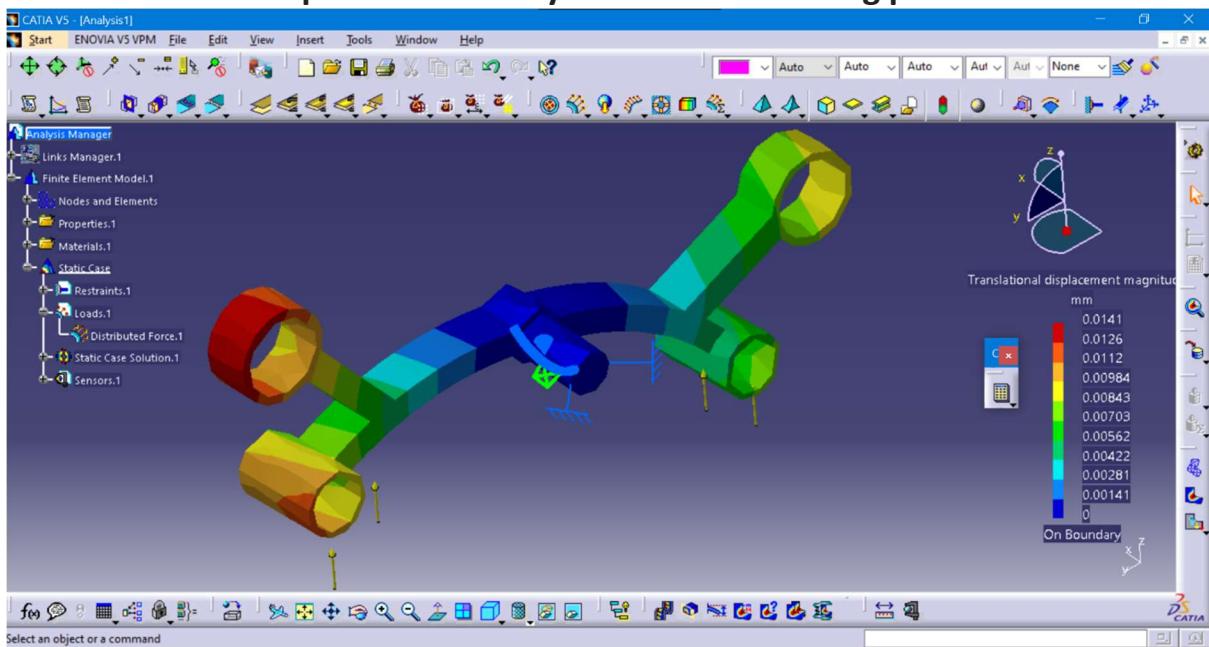
Displacement Analysis on the Front leg:



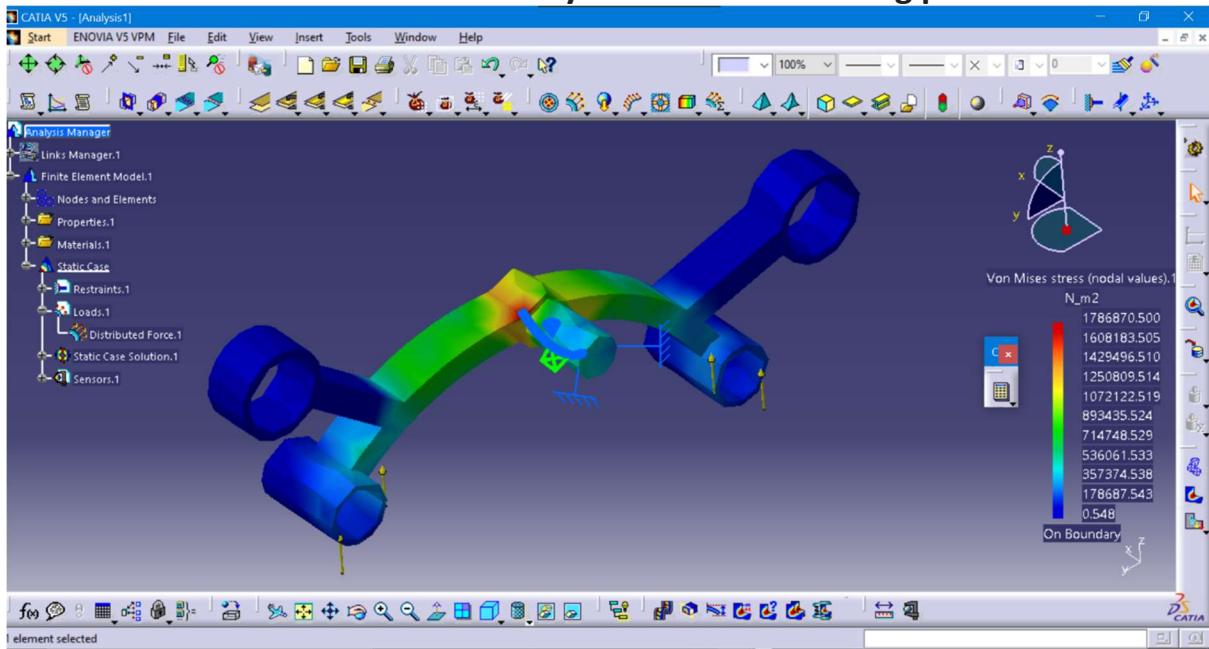
Principle Shearing Stress on the Front Leg:



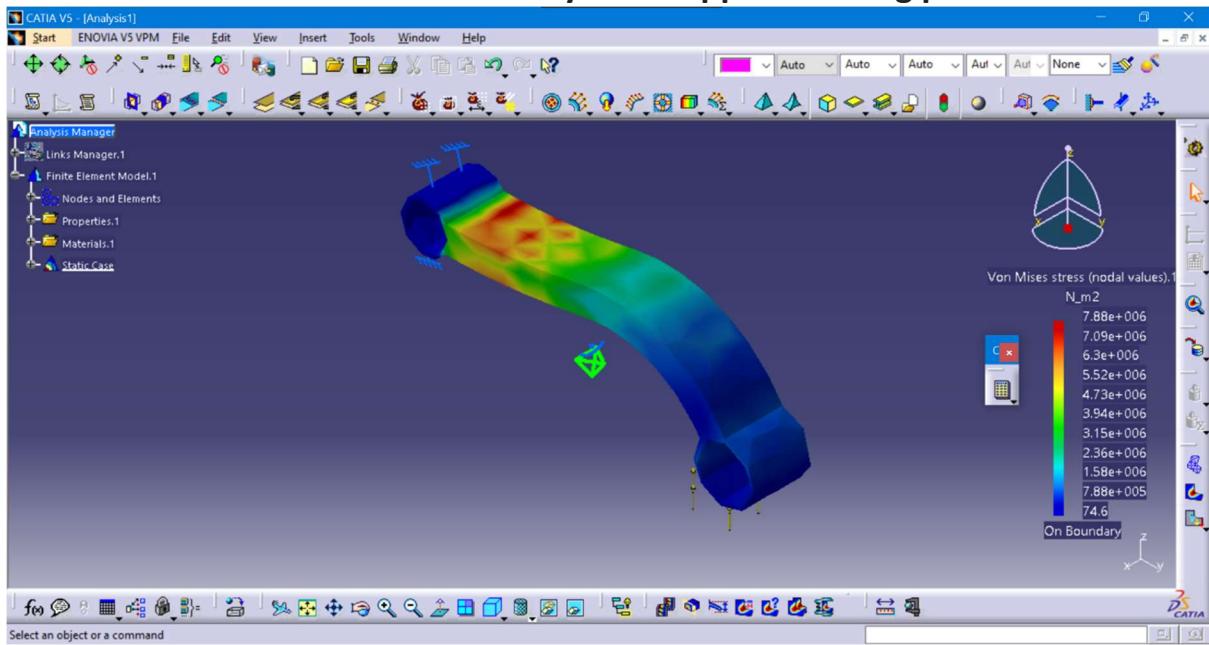
Displacement Analysis on Lower rear leg part:



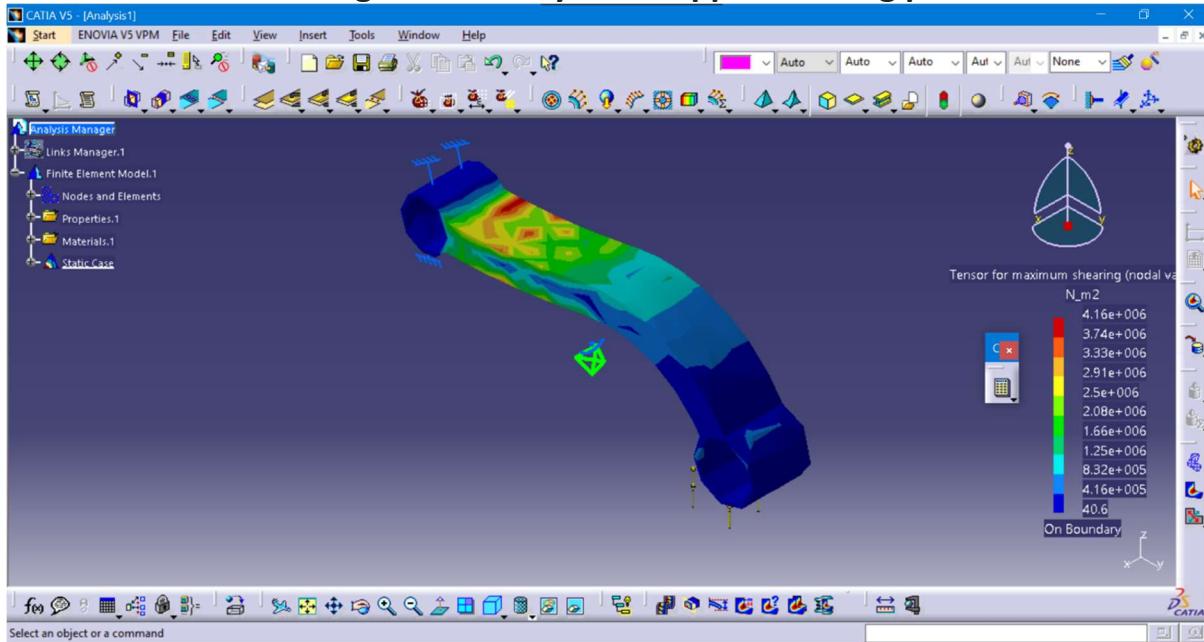
Von Mises Stress Analysis on Lower Rear Leg part:



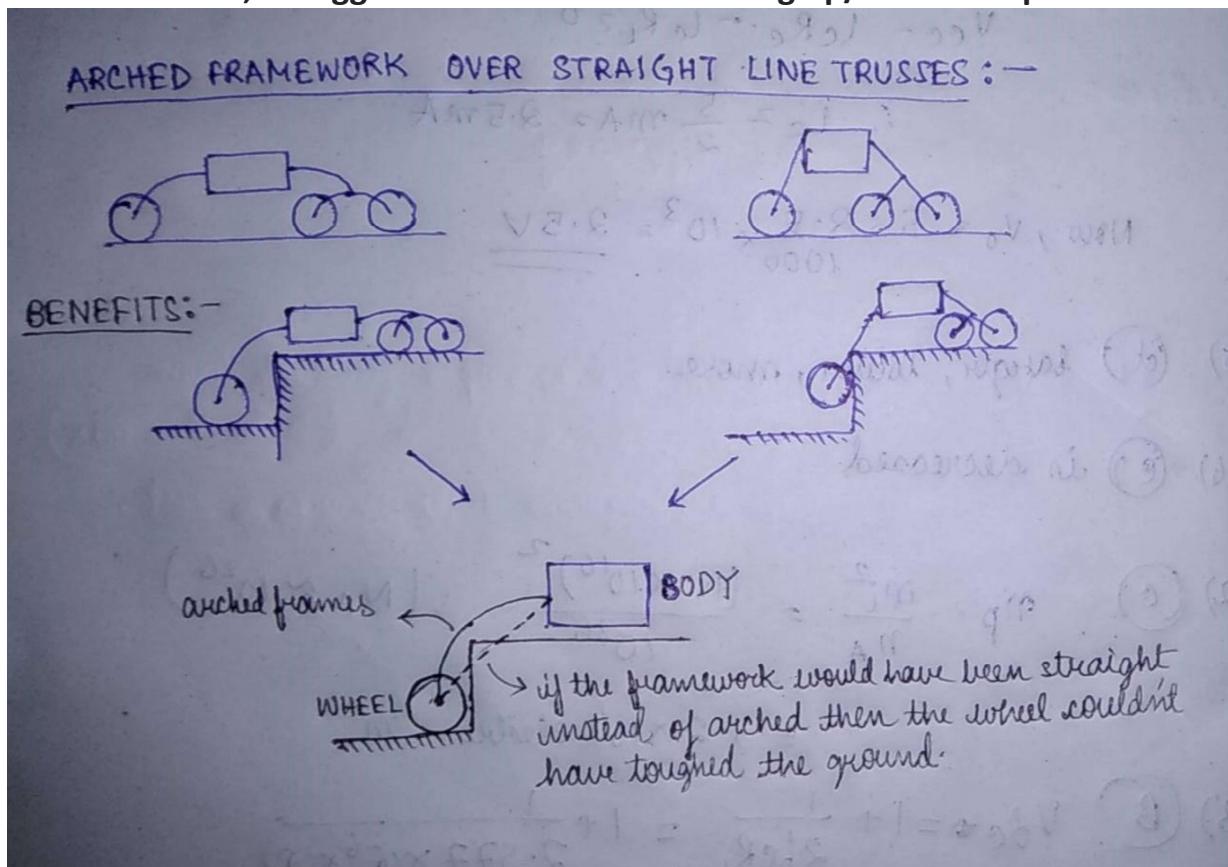
Von Mises Stress Analysis on Upper Rear Leg part:



Shearing Stress Analysis on Upper Rear leg part:

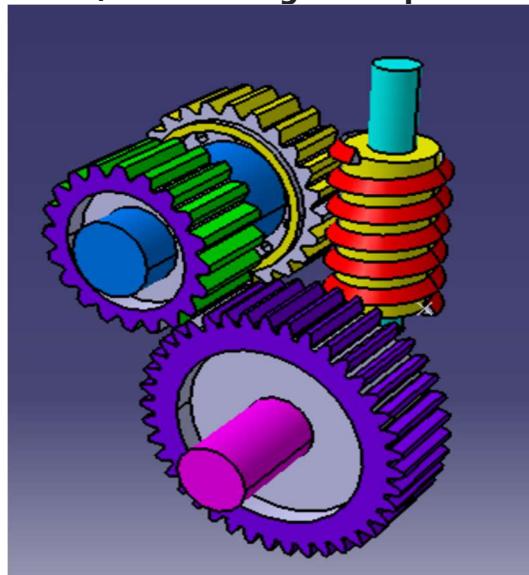


Sketch explanation of how a curved framework would increase the reach of the vehicle, in rugged terrain or while climbing up/down steep areas.

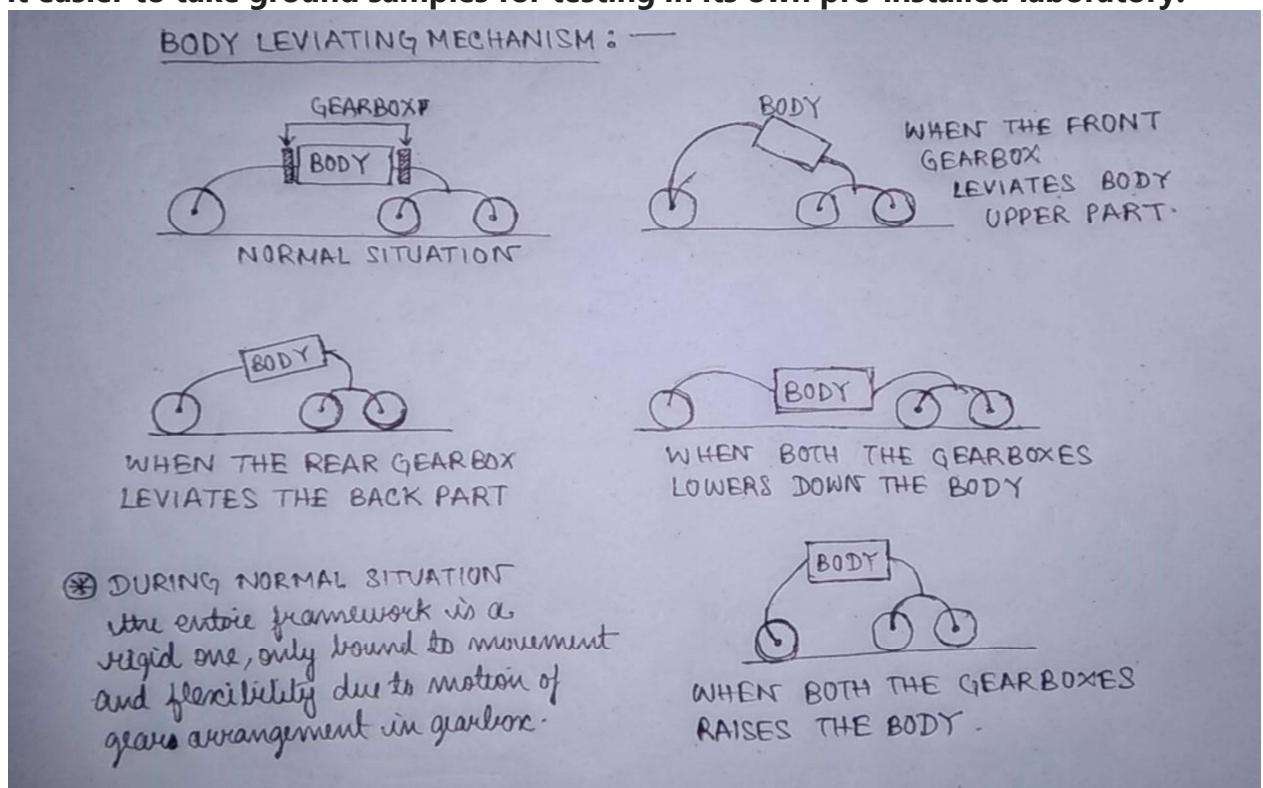


Gearbox: Present in each of the four sides of the Rover, connects the leg to the differential.

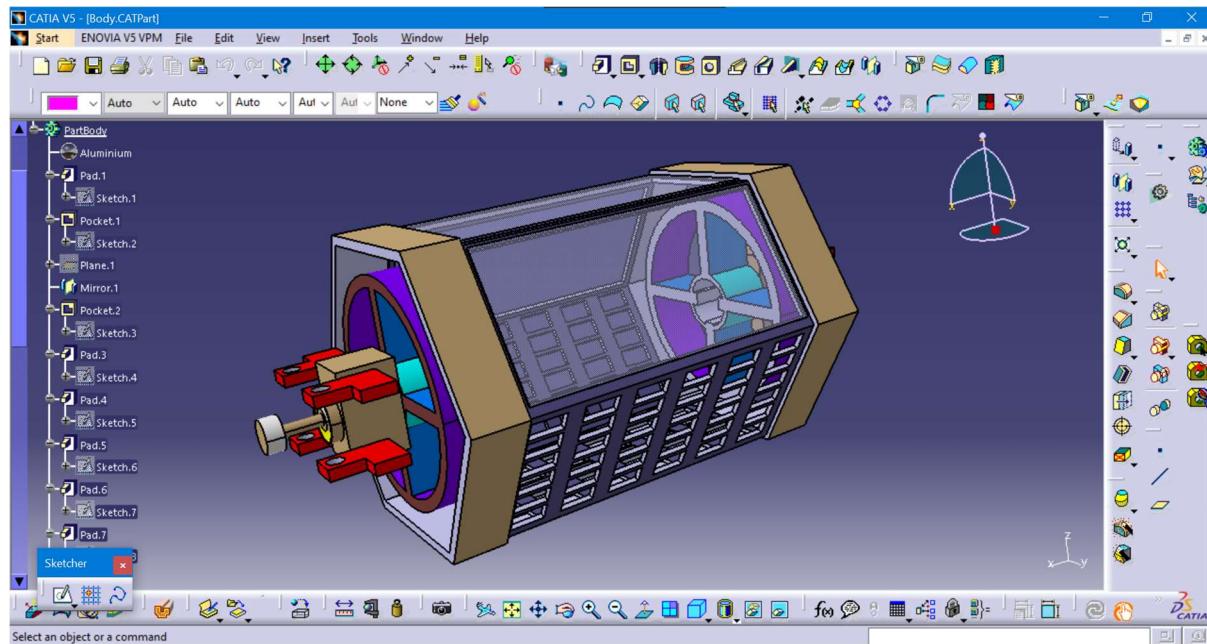
(Catia v5 , Gear Arrangement part design)



Sketch explanation of how the Gearbox would help the Rover body to ris/lower its height above the ground. It will also help the Rover maintain its centre of gravity while undergoing extreme manoeuvres. It will also enable a better scanning of images of the Martian ground by changing body height, or makes it easier to take ground samples for testing in its own pre-installed laboratory.



Body: The body of the Rover, connecting the front and the rear differentials. Its contains all the necessary electronic payloads, a pre-installed laboratory for testing ground samples and other systems inside it.



(Catia v5 , rover body design)

FINAL ASSEMBLY DESIGN:

