Analytical Simulation on a Rocker-Bogie Suspension System

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Abstract: In the planetary explosion rovers had an extraordinary role. Plans incorporate the utilization of the rocker-bogie meandered arrangement. In this paper the models of the mechanics of the arrangement is exhibited. Strategies for tackling the converse kinematics of the framework and semi static power investigation are portrayed. Likewise depicted is a re-enactment dependent on these particular models of the rover's execution. Trial results affirm the legitimacy of the models. NASA as of late began a goal-oriented investigation database of Mars. Pathfinder is the main adventurer in this program. New era of rovers should travel a few kilometres over times of months and control shake and soil tests. They, likewise, should be fairly self-governing.

IndexTerms **– Rocker-Bogie, Autonomous Vehicle, Robotics, Self-Driving Robot.**

I. INTRODUCTION

To plan and regulate these, logical replicas of how the rover cooperates with its condition are basic [1]. Models are additionally required for certain activity arranging [2]. Basic portability investigation of rocker-bogie vehicles are been created and developed for the performing various plan assessment [3]-[4]. In the accessible distributed works, the rocker-bogie design is demonstrated as a planar framework. Improving the exhibitions of a more straightforward four wheel rovers has likewise been investigated [5]. In this work, actuator excess and the situation of the focal point of mass of a vehicle is misused to for improving the traction. The strategy depends on on-going estimations of wheel/ground contact powers, which are hard to quantify practically speaking. Footing can likewise be improved by checking the skidding of the robot wheels on the ground [6]. However such a kind of 3D model has not yet been created with such a material. Further models that includes the controller's impact are likewise required to successfully arranging and controlling the activities of the rover. For instance it is vital for an organizer to probably anticipate if a rover can effectively arrange a given territory obstructions, This paper particularly portrays a physical model of a rocker-bogie suspension system using a light weight material and can be used for smaller implementations and the simulation and analysis.

II. WHY ROCKER-BOGIE SUSPENSION SYSTEM OVER OTHER DESIGNS?

Though there are thousands of reasons for using a Rocker-Bogie suspension system, the following lines state the consolidated reason to do so. It doesn't either have axles or springs which gives it an equivalent footing power on each individual wheels. It is capable of climbing over the obstacles or burdens in front of it as it can climb or overcome a height that is twice the height of the wheel which simultaneously keeps any one of the six wheels on the land. All the individual wheels are capable of holding the whole weight or mass of the body on its own. Similarly when compared with any suspension framework, the tilt reliability is restricted by the height of the focal point of gravity.

Most of the robots are being used to do certain task which involves risk for humans and even the tasks that humans cannot do. Hence robots are made for this purpose and are designed in such a way that they are suitable for that particular task. Rocker bogie suspension system was one among these designs which used in NASA. There are two major advantages for this mechanism one of it is that its pressure of the wheel on the ground will be same and mostly equilibrated and this is most important in soft terrains where there is excessive ground pressure can result in sinking of the vehicle. One of the other specialty is that during climbing over hard rough surfaces as all the wheels will be having a contact with the ground or surface.

III. MATERIALS USED

The prototype of the rocker body suspension is made in such a way that it reduces its weight and attains the similar property as well as can be used for smaller scale uses and can be implemented. The main material that being used for the prototype is PVC pipes (polyvinyl chloride). This is the most used thermoplastic polymer. It is brittle and mostly used for construction purposes in such industry and also are being used for many uses like healthcare and for production of fiber for clothing. As these PVC's are produced mainly in two forms in which one is rigid and the other one is flexible plastic. Both of these pipes are used for different purposes. The significant properties of PVC's are;

1. Density: when compared to most plastics PVC's are dense and it has a specific gravity which is around 1.4.
2. PVC's are economically easily available and cheap.
3. The tensile strength of a rigid PVC is extremely good.

The PVC pipes that are used for the purpose is about one and a half inches diameter and rigid PVC's are being used. It consists of two caps and four 90 degree elbows as well as six 45 degree elbows are also being used.

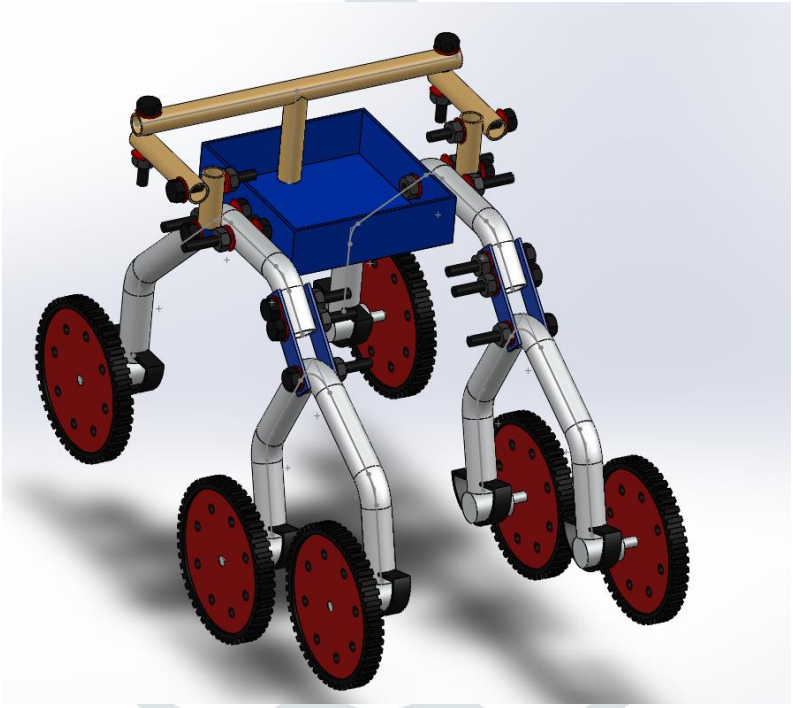
Motor used: Geared dc motor which has a speed of 100 rpm and 12 volts have been used. A geared DC Motor has an setup which is connected to the engine. The speed of engine is included regarding revolutions of the pole every moment and is named as

RPM .The apparatus get together aides in expanding the torque and diminishing the speed. Utilizing the right blend of apparatuses in a rigging engine, its speed can be decreased to any attractive figure. This idea where gears diminish the speed of the vehicle yet increment its torque is known as gear reduction. This Insight will investigate all the minor and significant subtleties that make the apparatus head and henceforth the working of outfitted DC engine. Here we are using 6 wheels, hose clip PVC pipe clamp, nuts and bolts. This autonomous rover will be having ultrasonic sensors and they are used to detect the distance of the obstacle which is in front of it. GPS tracking module is used to enable the rover to be navigated from one particular location to another.

IV. MODEL

The modelling is done in the software SOLIDWORKS 2016 version according to the required dimension and calculation in which each parts were made separately and later on were combined and assembled for the further analysis. The prepared model was of length (30cm) x width (20cm) x height (25cm). A Static Structural Analysis was performed on the assembled model. This analysis was done so as to find the deformation, stress and strain acting on the structure in static condition due to the weight of the batteries and other electrical equipment present on top of the main body. The weight acting on the body is 1kg.That produces a force of 9.8 N on the inner surface of the body. So the pressure on the body was calculated by considering the area of that surface which was found to be 335.62 Pa. Using this value the analysis was done and hence various parameters like stress, strain and deformation were found out.

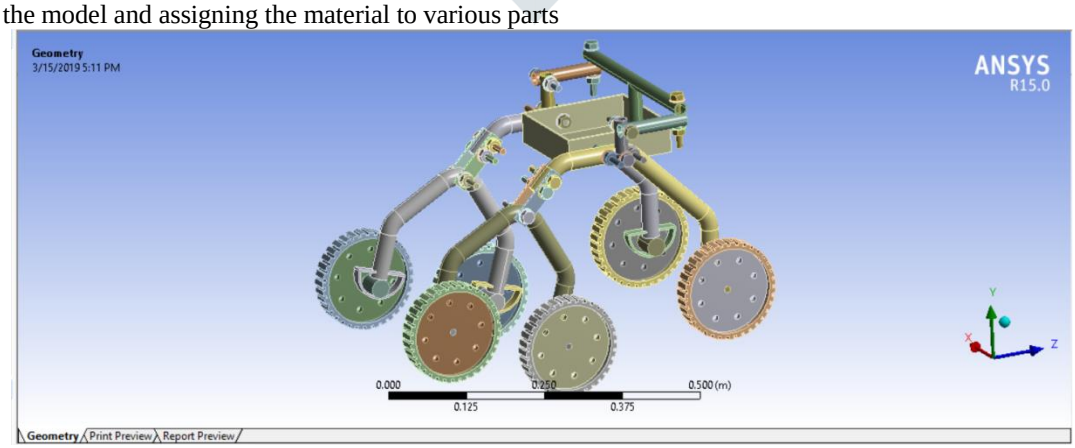
V. ASSEMBLED MODEL DESIGN



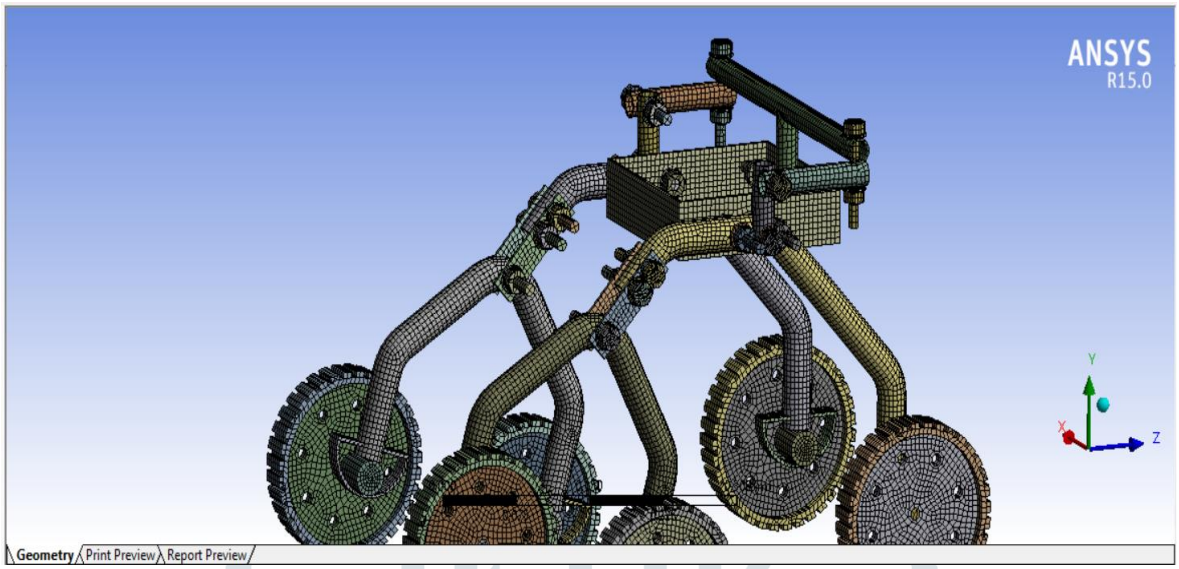
VI. ANALYSIS

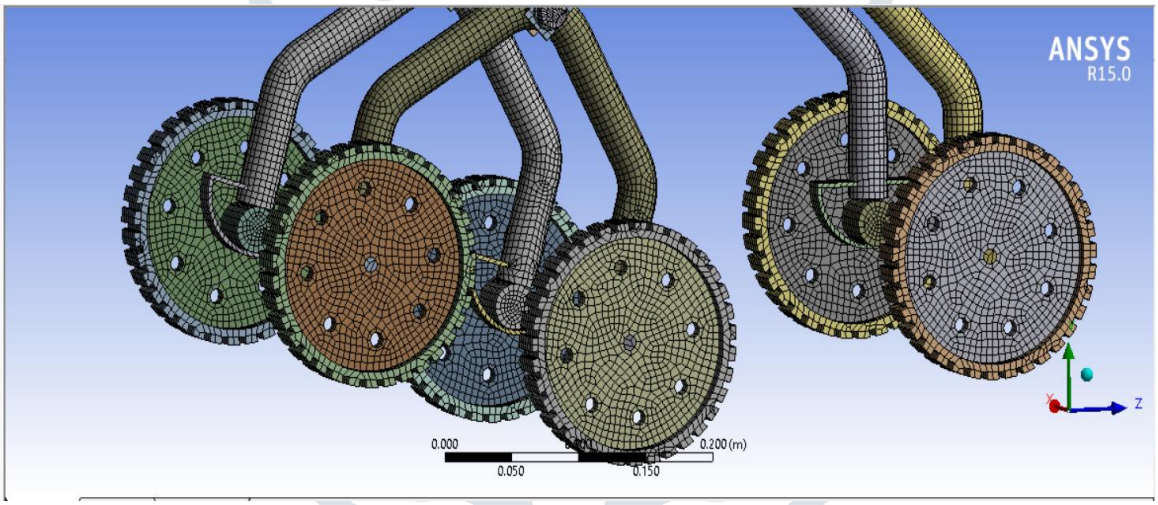
The Various Steps involved in analysis are:

1) Importing the model and assigning the material to various parts

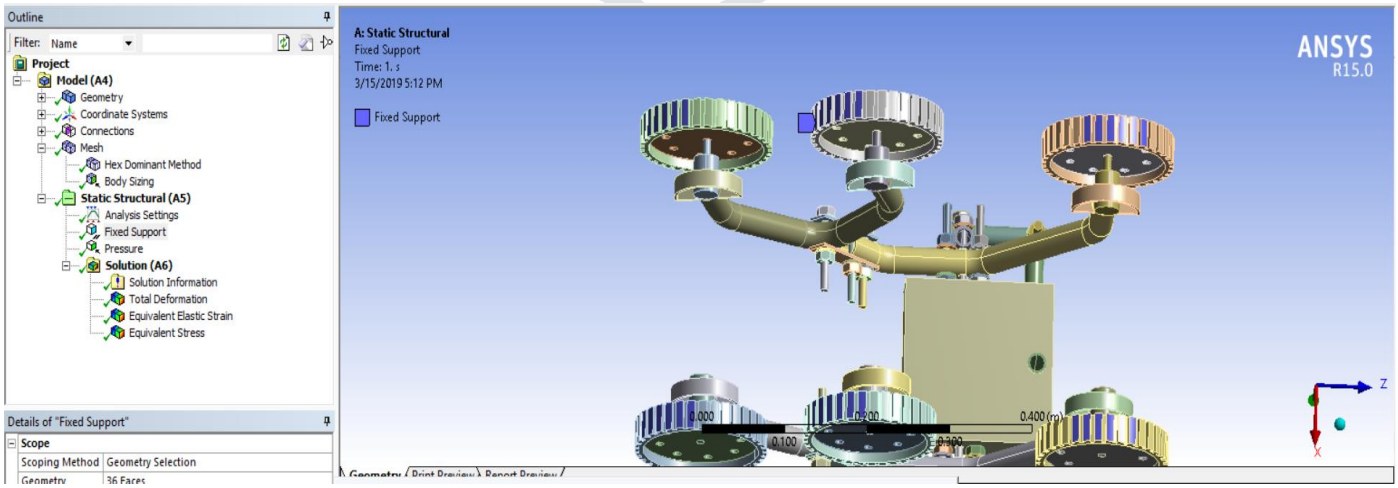


2) Meshing various parts of the model

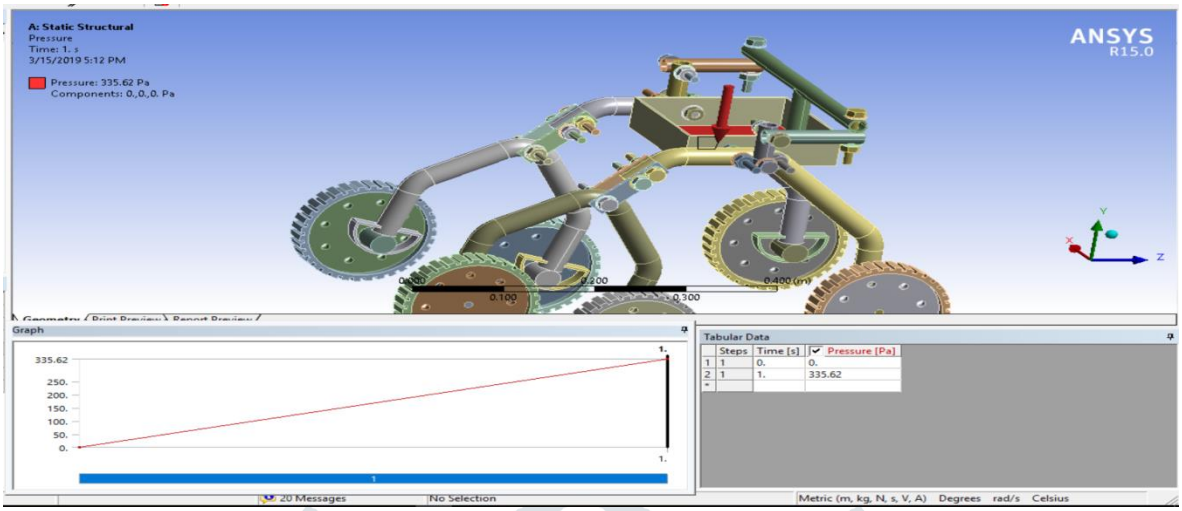




3) Assigning the fixed support



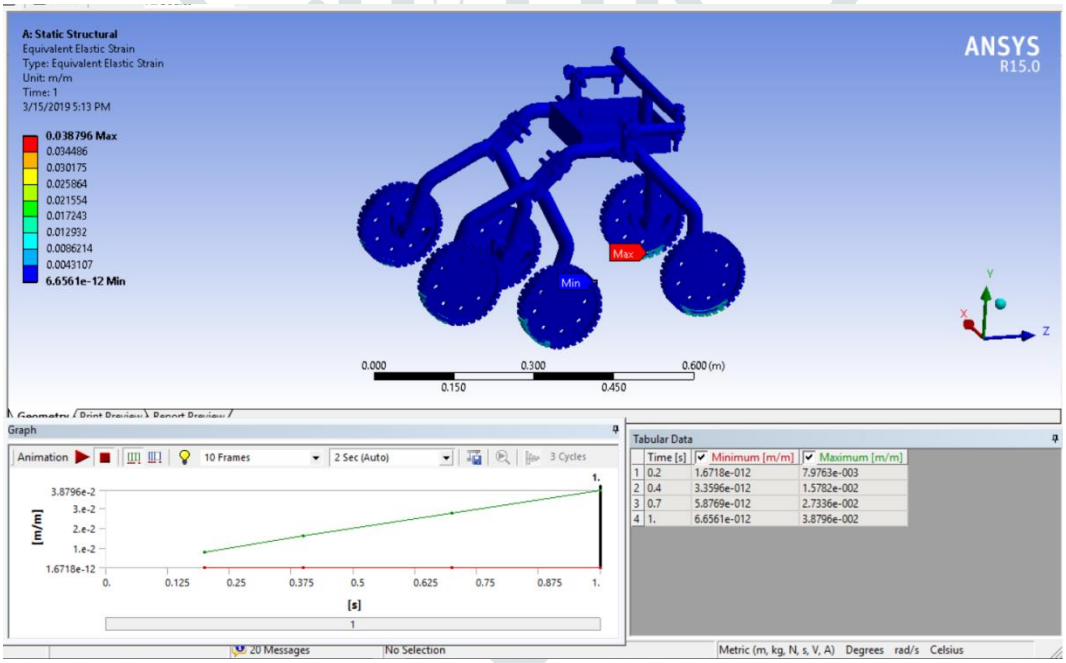
4) Applying the applicable pressure



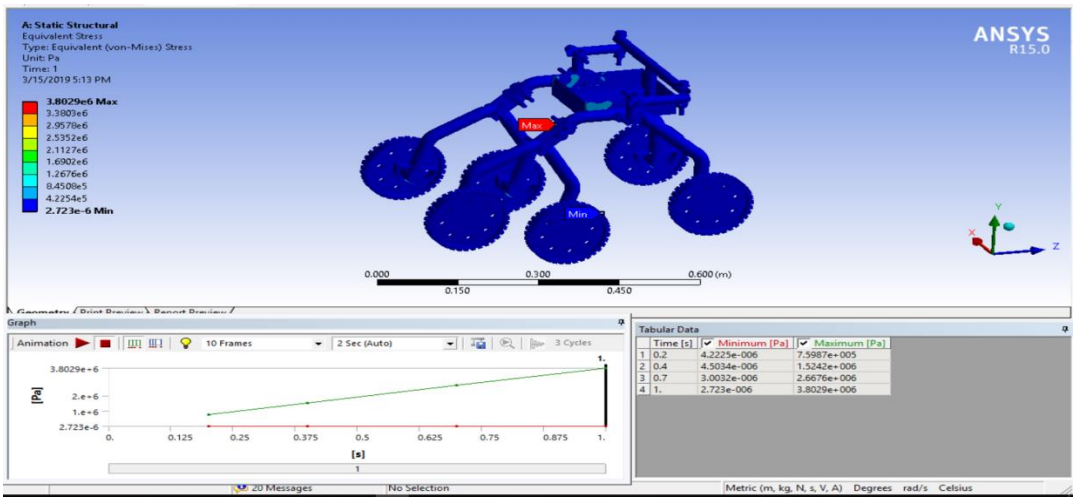
5) Solving

VII. RESULTS

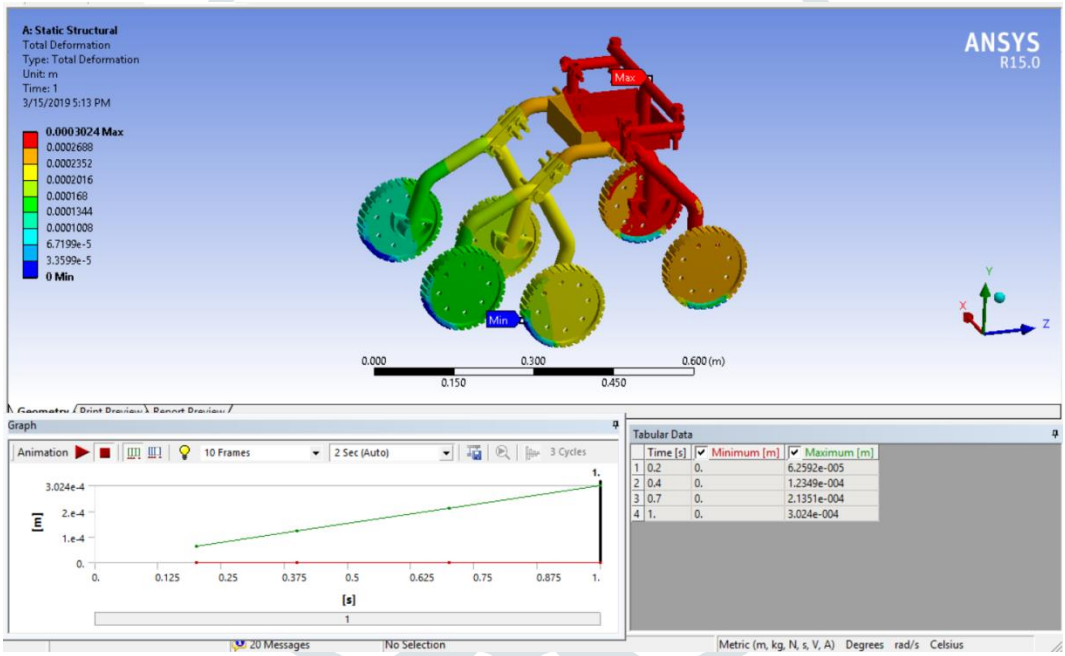
1) Strain:-



2) Stress:-



3) Deformation:-



VIII. Conclusion

The analysis provides us the information on the critical areas in the structure i.e., the maximum and minimum values of deformation, stress and strain acting on the structure as well as the area that it is acting on.

IX. Acknowledgment

The complete work is carried out in CDI, CHRIST (Deemed to be University), Bengaluru, India.

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