

3rd Design Competition on Additive Manufacturing

(Design Problem & Criteria)

1. Problem:

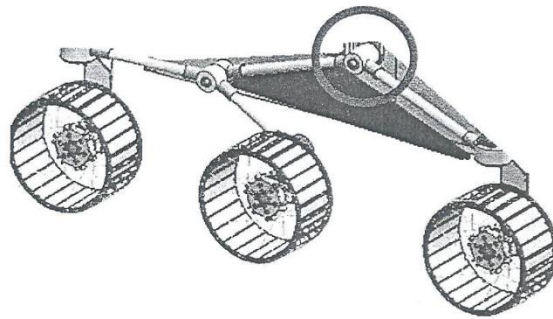
Design of a Y-Joint Rocker Bogie Mechanism for application in six wheeled Space Rover Locomotion and Suspension System

2. Introduction:

In Space rover Locomotion system, Rocker Bogie Mechanism is crucial for improved maneuverability in harsh terrains. The Y joint of Rocker Bogie Mechanism is a critical component of the overall assembly and is subjected to tensile loads and bending moments. The milestones of designing the Y-Joint for the Space Rover includes minimum possible weight, incorporating loading conditions.

3. Sample:

The sample designs for the Rocker Bogie Joint for the space rover is provided below for REFERENCE ONLY:

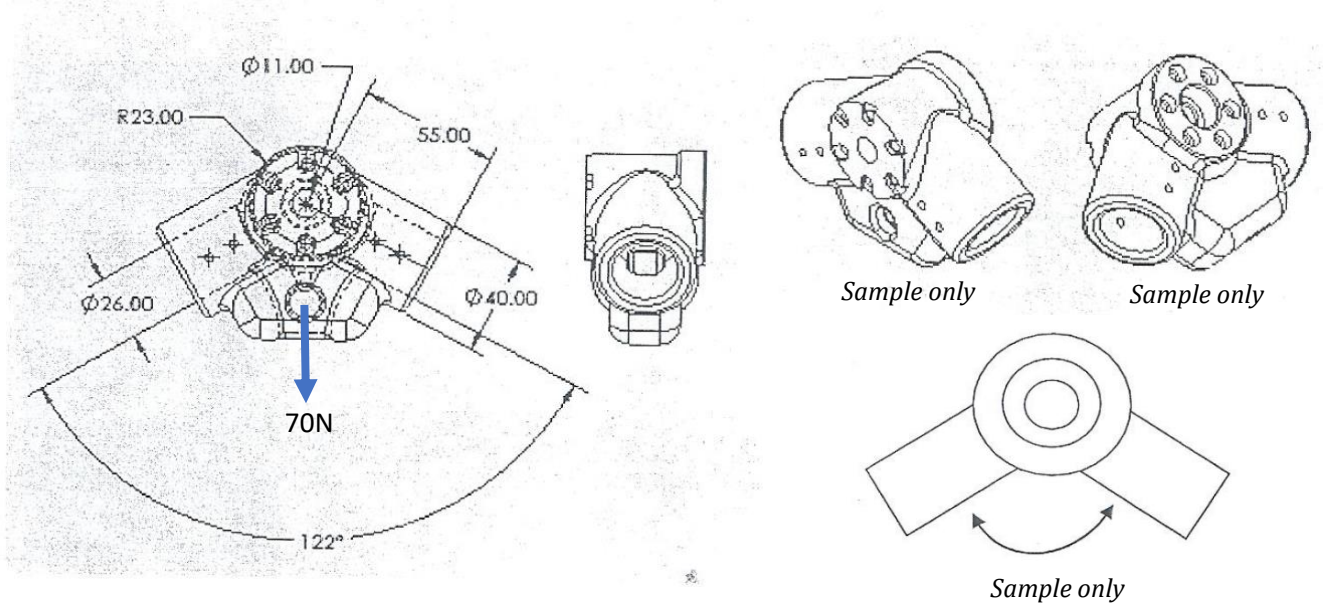


Rocker bogie mechanism with Y joint

4. Design Specification:

| Sr no. | Attribute | Requirements | Remarks |
|--------|-----------------------------------|----------------------|--|
| 1. | Mass | $\leq 100\text{g}$ | Minimum possible weight |
| 2. | Material | ABS | - |
| 3. | Dimension | Please Refer Drawing | - |
| 4. | Load Bearing Capacity | 70N | This is the max loading condition to evaluate the design |
| 5. | Maximum External Diameter | 40mm | The external diameter should be between 26mm and 40mm |
| 6. | Internal Diameter | 26mm | Please Refer Drawing |
| 7. | Angle for Y joint | 122° | Please Refer Drawing |
| 8. | Length of joint sleeve (One side) | 55mm | Please Refer Drawing |

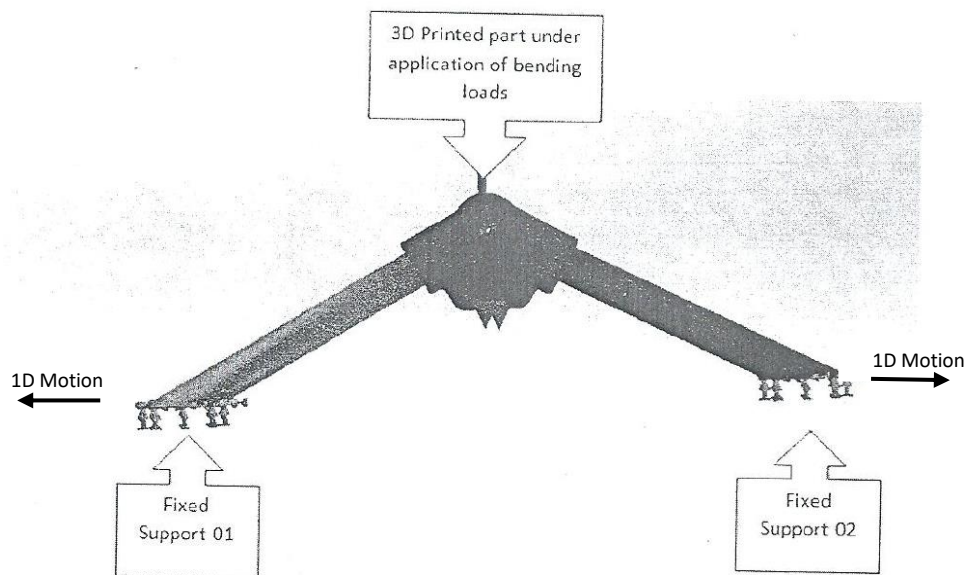
4.1 Drawing:



Sample Drawing of the Y joint

5. Design of Y Joint

The Y joint should be designed to provide Z axis deflection in the range of 1 to 5mm, providing adequate strength to the Y joint to support a Load of 70N. The Rods on which the Y joint will be mounted will have a 1degree freedom as shown in the image below allowing the Y joint to show deflection under 70N loading condition.



Conceptual design of testing rig

6. Criteria for Design Approval:

Following is the criteria for design approval for the design competition:

1. Any available CAD software (SolidWorks, Pro-E, Solid Edge, CATIA etc.) can be utilized to design the Y joint as per provided design constraints.
2. It should incorporate a 10mm hole at base for the fixing the load (see isometric View)
3. Static structural analysis on a simulation software (Ansys, Abaqus etc) should be performed on the part design with a load of 70N.
4. The weight must be $\leq 100g$ excluding the support structure.
5. The dimensions of the model should be within the range of the provided sample drawings.
6. Only the designs full filling the above requirements will be shortlisted for 3D printing.

7. Criteria of Success

Following is the criteria of success for finalized designs:

1. The designed Y joint component with qualified static analysis showing best load sustainability up to crack initiation will be selected as the successful design.
2. The designs that qualify the structural analysis will then be shortlisted having minimum mass.
3. The shortlisted designs will be then 3D printed and placed on the testing rig. A load of 70N will be applied on the Y joint at the mentioned location.
4. The design showing the deflection within a range of 1mm to 5mm at maximum load will then qualify for the winning position.
5. The design with qualified structural analysis, minimum weight and deflection within range will be awarded the wining position.

8. Documents to Submit

Following details must be submitted for qualification of the design in the competition

1. Detailed structural analysis report needs to be submitted in the form of PDF showing the mentioned results.
2. CAD design in the form .step & .igs along with high tessellation .STL file should be submitted before the provided date.