Team MEDextrous

Bore Well Child Rescue System

Proposed & Designed By: -

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Abstract & Insight

Today's major problem faced by human society is water scarcity, which leads to a large number of bore wells being sunk. These bore wells in turn have started to take many innocent lives. Bores which yielded water and subsequently got depleted are left uncovered. Small children without noticing the hole dug for the bore well slip in and get trapped.

Abstract

However, the safety of the boreholes dug is always questioned. News of the children struck in boreholes are always heard but mostly neglected. There is still not a proper system or method to rescue a child stuck in a borehole. Big rescue operations are planned which takes a lot of time and these holes does not provide a safe space so that one can reside over a long time. Due to lack of oxygen in the boreholes, there is a need for the faster rescue. In some makeshift methods, some kind of hooks are employed to hold the sufferer's clothes and body. This may cause wounds on the body of the subject.

Problem

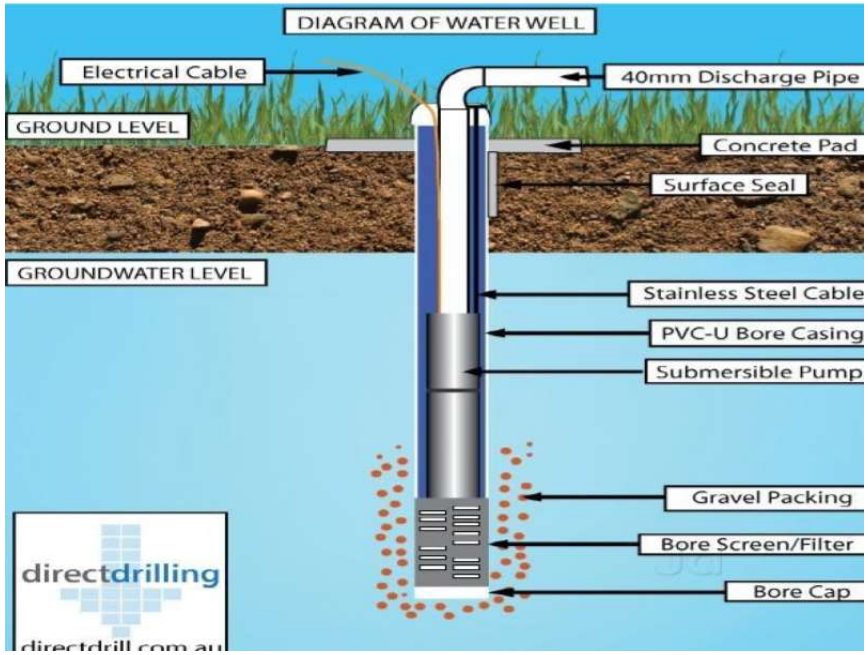
This machine has been designed to rescue the trapped child from the bore well. This project is an approach towards removing such difficulties in the rescue and to carry out the extraction process so that a life can be saved.

Solution

About

Bore Well

A deep, narrow well for water that is drilled into the ground and has a pipe fitted as a casing in the upper part of the borehole, typically equipped with a pump to draw the water to the surface. Depth of the bore wells can go from 100 feet to 1700 feet. Diameter of the bore well varies up to 12 inches.



Usefulness & Application

Its unique capability to drive inside the cylindrical object (pipe) makes it possible to serve in the following areas:

1. *As bore well child saver: -* The main application of the machine is in the rescue operation of the child from the bore well.

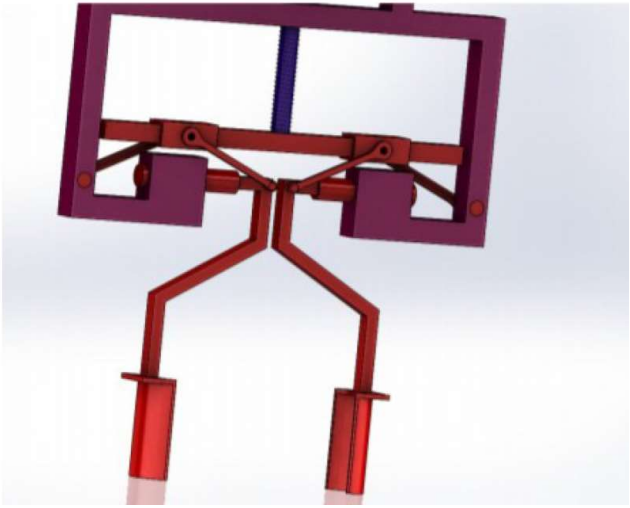
2. *As Pipe cleaning machine:* - This machine can be used in pipe cleaning. It can drive through long pipes and with a rotary brush as an end effecter fitted at front will serve the cleaning operation of dirty pipes. As the inside surface of the pipes may be wet and slippery the high-quality wheels are capable to grip on the wet surface.

3. *As pipe inspection machine:* - In pipe manufacturing industries the final product is required to go through inspection process for quality control and prevent any leakage in pipes or any oil, gas pipe lines are to be surely free from any kind of leakage and damage as it may cause huge destruction if any kind of accidents takes place. This inspection machine loaded with special inspection instruments like sensors, x-ray is capable to inspect pipes, thus can detect any kind of defect which may be the reason for a serious accident.

Design and Components

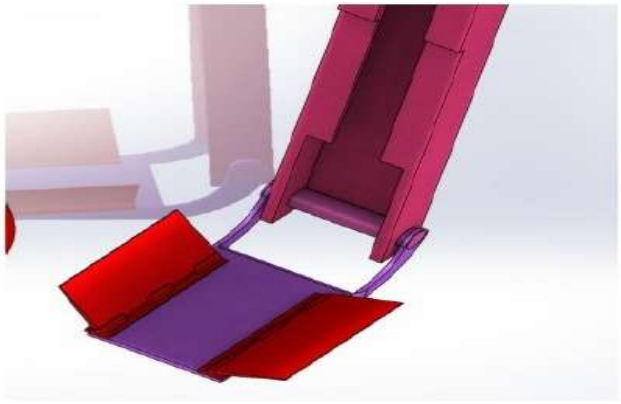
1. Mechanical Gripper

The main function of the gripper is to hold the child in one position while he is being rescued. While rescuing child his body may slide with the borehole walls which can cause injuries, so to avoid injuries to child being rescued, a stable system is designed to keep the body proper aligned for the safe extraction. Lower arms of the gripper acts as the gripping points which grabs the shoulder of the child. Lead screw is connected to the upper strut which is constrained to move up and down to perform the gripping action. The gripper is also equipped with a camera and led lights so that a visual aid can be provided to the rescuers.



2. Pulley

Pulleys are used to reduce the time and energy taken to lift heavy objects. A fixed pulley system is used which is used to lift the full system. Pulley system is designed such that it can take the load of child as well as the other components of the structure. The major concern in designing the pulley system was that the shaft supporting the pulley should not fail due to bending.

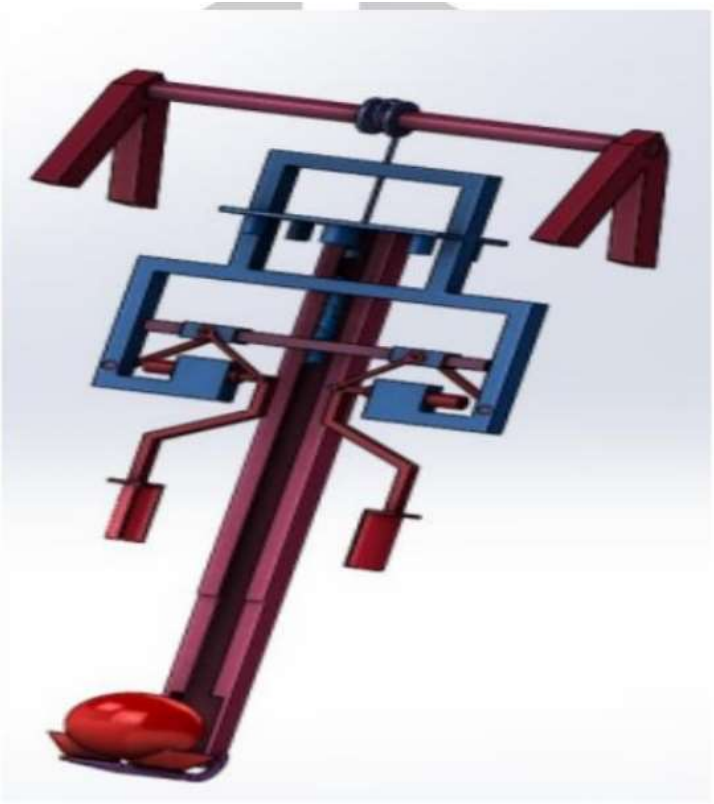


3. Foot Support System

It provides vertical support to the feet of the child. This component ensures proper weight shift and balance on the system otherwise it will become unstable and child may get stuck.
To avoid such problem a vertical support system is designed which consists of flaps, which open when the lower vertical arm of the structure is below the body of the child. Flaps contain a balloon which will be inflated with an inflator so that the maximum area can be provided for the feet of the child to adjust.
Feet of the child reside on the balloon shown in the picture above and the body remains parallel to the vertical limb. This system will also ensure that child does not get hurt while pulling up.

Complete View and Execution

The complete picture of the assembled structure is shown below and now it can be visualized how the whole system will work. The upper shaft containing pulley will be placed along the diameter of the borehole and the lower parts including mechanical gripper, foot support are lowered down through the hole lightings and camera loaded on the gripper will be used to see how a child is stuck and two pipes will go along the frame downward one will be for the continuous oxygen supply and other one for the inflation of the balloon.



Simulations & Specifications

Simulation of Auto Recover Of Collecting Rod

Auto Collecting Rod

Model Information

Model name: AutoRecover Of colllecting rod
Current Configuration: Default

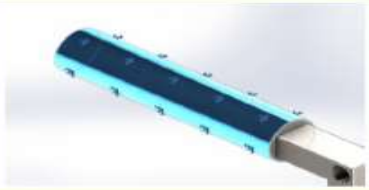
Solid Bodies

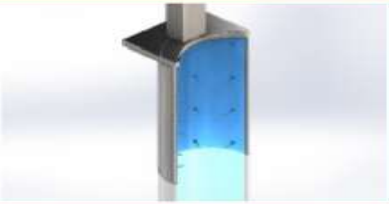
Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
Cut-Extrude2 	Solid Body	Mass:0.252449 kg Volume:3.27856e-05 m^3 Density:7700 kg/m^3 Weight:2.474 N	C:\Users\Asus\Documents\Projects\Borewell\solidworks design\Gripper\colllecting rod.SLDPRT Oct 10 21:33:46 2020

Material Properties

Model Reference	Properties	Components
	**Name:** Alloy Steel **Model type:** Linear Elastic Isotropic **Default failure criterion:** Max von Mises Stress **Yield strength:** 620.422 N/mm^2 **Tensile strength:** 723.826 N/mm^2	SolidBody 1(Cut-Extrude2) (AutoRecover Of colllecting rod)

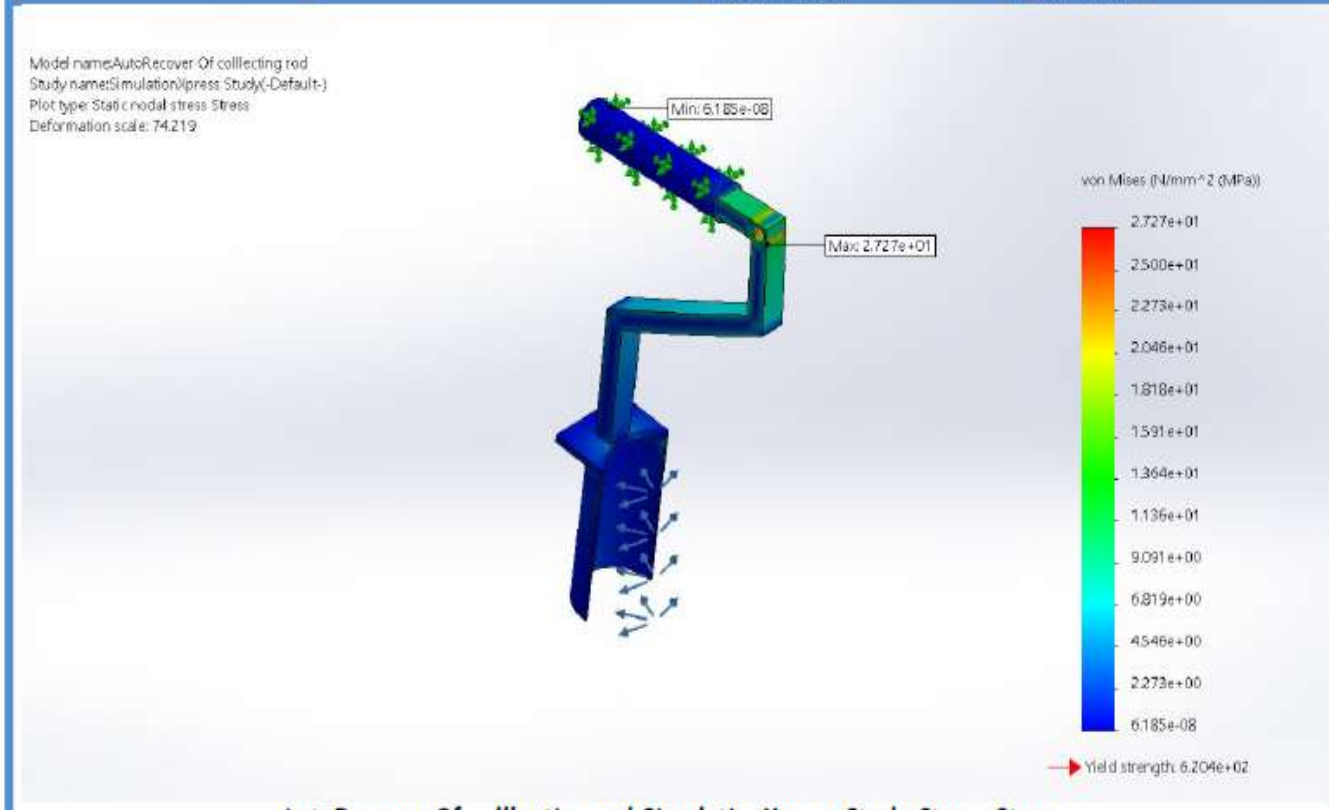
Loads and Fixtures

Fixture name	Fixture Image	Fixture Details
Fixed-1		**Entities:** 1 face(s) **Type:** Fixed Geometry

Load name	Load Image	Load Details
Force-1		**Entities:** 1 face(s) **Type:** Apply normal force **Value:** 10 N

Study Results

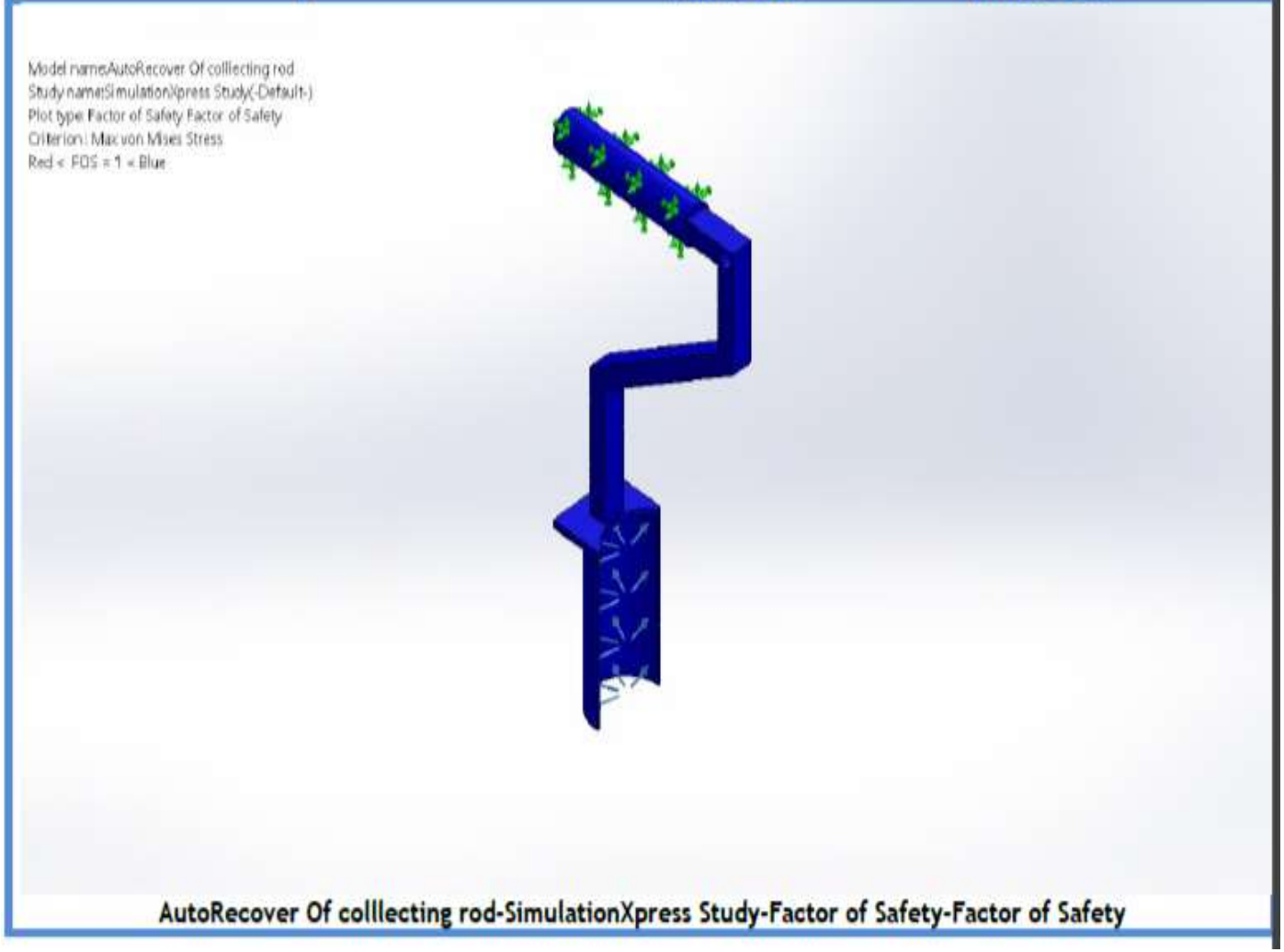
Name	Type	Min	Max
Stress	VON: von Mises Stress	6.185e-08 N/mm^2 (MPa) Node: 14019	2.727e+01 N/mm^2 (MPa) Node: 1221



AutoRecover Of colllecting rod-SimulationXpress Study-Stress-Stress

Name	Type	Min	Max
Displacement	URES: Resultant Displacement	0.000e+00 mm Node: 30	2.870e-01 mm Node: 292

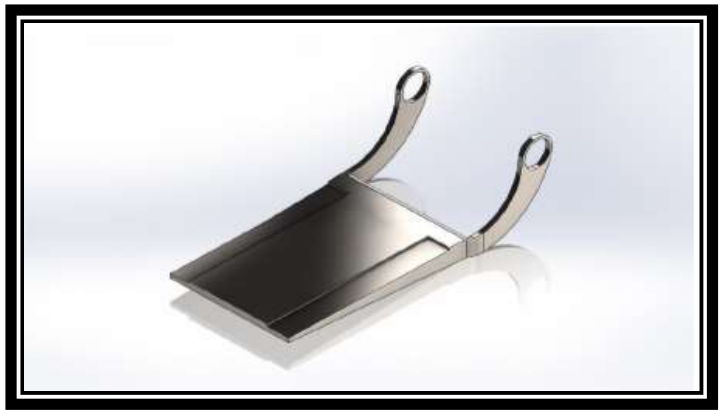
Name	Type	Min	Max
		Node: 1221	Node: 14019



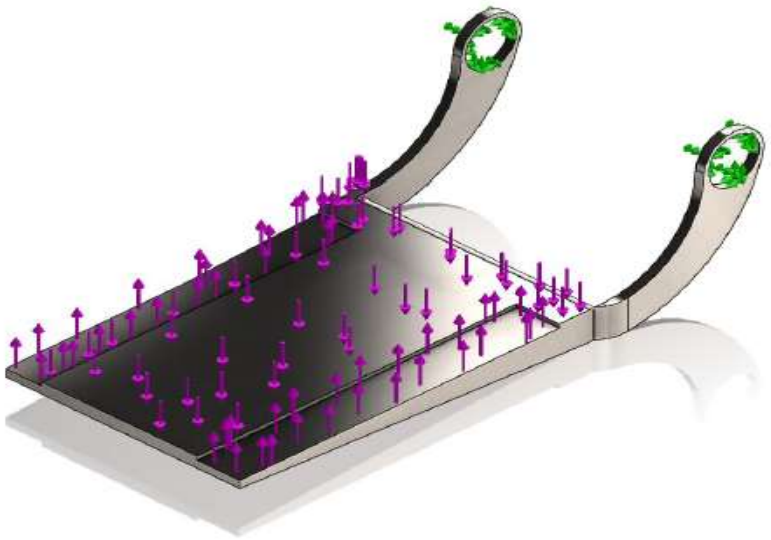
AutoRecover Of colllecting rod-SimulationXpress Study-Factor of Safety-Factor of Safety

Simulation of Slit Plate

Slit Plate

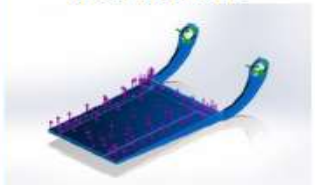


Model Information

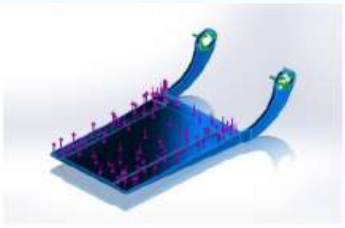


Model name: slit plate new
Current Configuration: Default

Solid Bodies

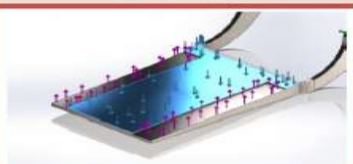
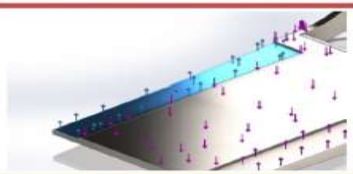
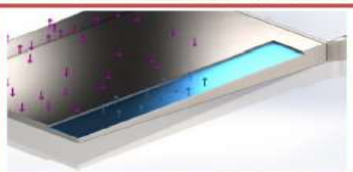
Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
Cut-Extrude12 	Solid Body	Mass:0.201746 kg Volume:2.62008e-05 m^3 Density:7700 kg/m^3 Weight:1.97711 N	C:\Users\Asus\Documents\Projects\Borewell\solidworks design\slit plate new.SLDPRT Oct 11 10:48:21 2020

Material Properties

Model Reference	Properties	Components
	**Name:** Alloy Steel **Model type:** Linear Elastic Isotropic **Default failure criterion:** Max von Mises Stress **Yield strength:** 620.422 N/mm^2 **Tensile strength:** 723.826 N/mm^2	SolidBody 1(Cut-Extrude12)(slit plate new)

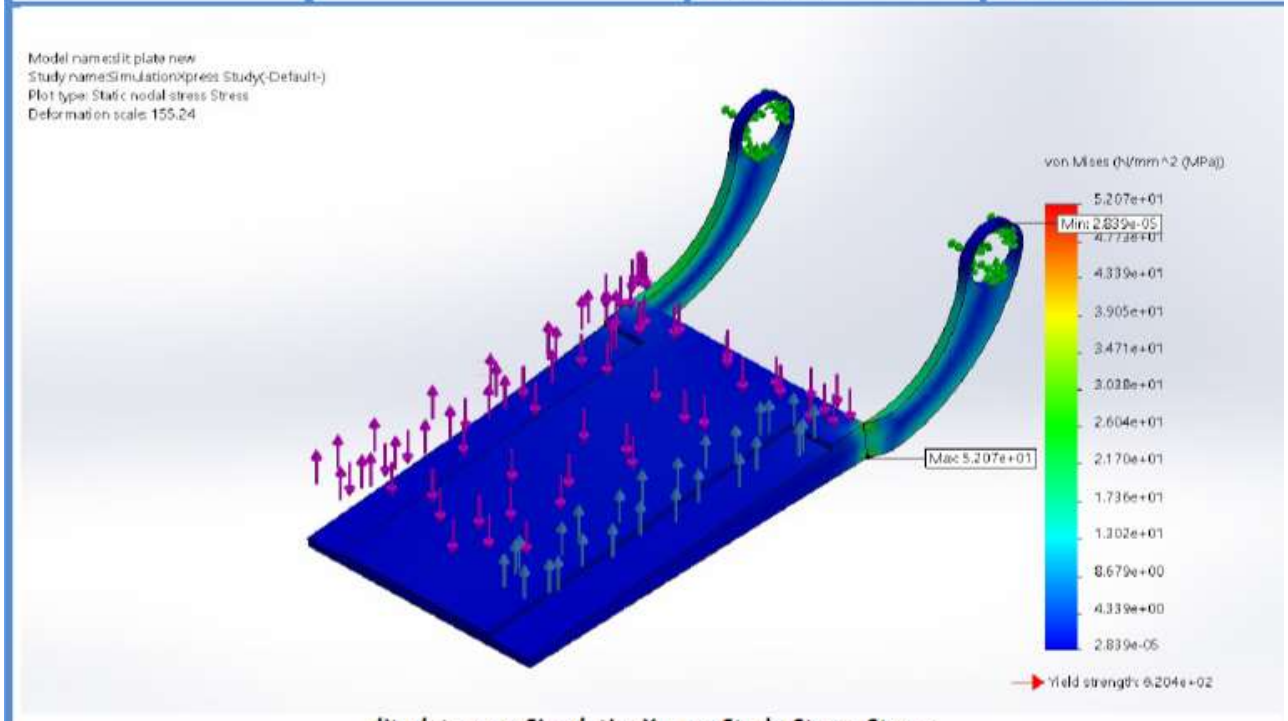
Loads and Fixtures

Fixture name	Fixture Image	Fixture Details
Fixed-1		**Entities:** 2 face(s) **Type:** Fixed Geometry

Load name	Load Image	Load Details
Force-1		**Entities:** 1 face(s) **Type:** Apply normal force **Value:** 25 N
Force-2		**Entities:** 1 face(s) **Type:** Apply normal force **Value:** -4 N
Force-3		**Entities:** 1 face(s) **Type:** Apply normal force **Value:** -4 N

Study Results

Name	Type	Min	Max
Stress	VON: von Mises Stress	2.839e-05 N/mm^2 (MPa) Node: 13395	5.207e+01 N/mm^2 (MPa) Node: 12452

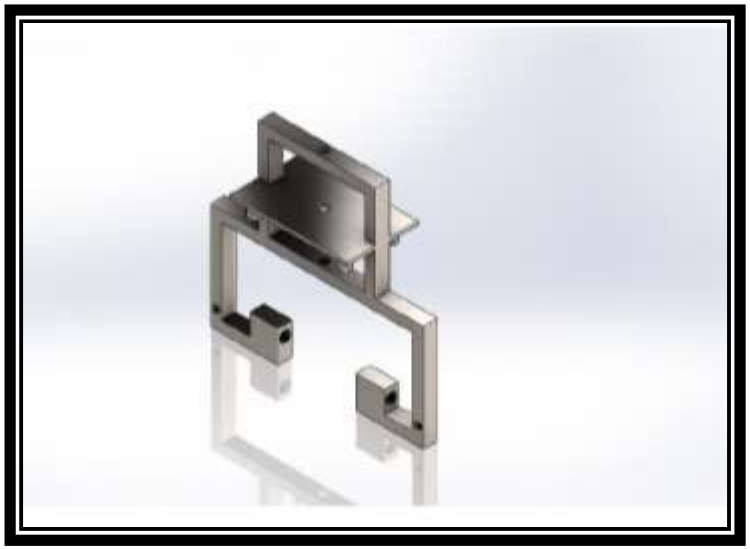


slit plate new-SimulationXpress Study-Stress-Stress

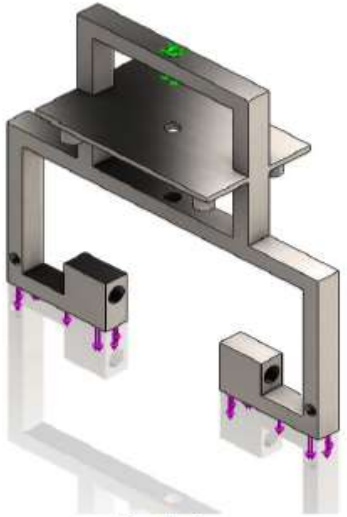
Name	Type	Min	Max
Displacement	URES: Resultant Displacement	0.000e+00 mm Node: 1	7.800e-02 mm Node: 97

Simulation of Supporting Body

Supporting Body



Model Information



Model name: supporting body
Current Configuration: Default

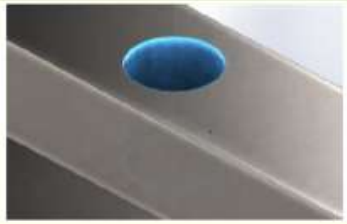
Solid Bodies

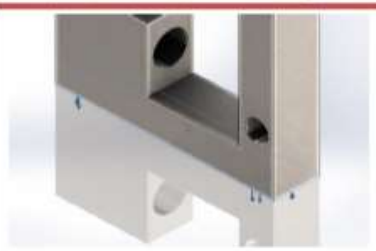
Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
Boss-Extrude4 	Solid Body	Mass:3.64519 kg Volume:0.000473402 m^3 Density:7699.99 kg/m^3 Weight:35.7229 N	C:\Users\Asus\Documents\Projects\Borewell\solidworks design\Gripper\supporting body.SLDPRT Oct 13 20:23:20 2020

Material Properties

Model Reference	Properties	Components
	**Name:** Alloy Steel **Model type:** Linear Elastic Isotropic **Default failure criterion:** Max von Mises Stress **Yield strength:** 620.422 N/mm^2 **Tensile strength:** 723.826 N/mm^2	SolidBody 1(Boss-Extrude4) (supporting body)

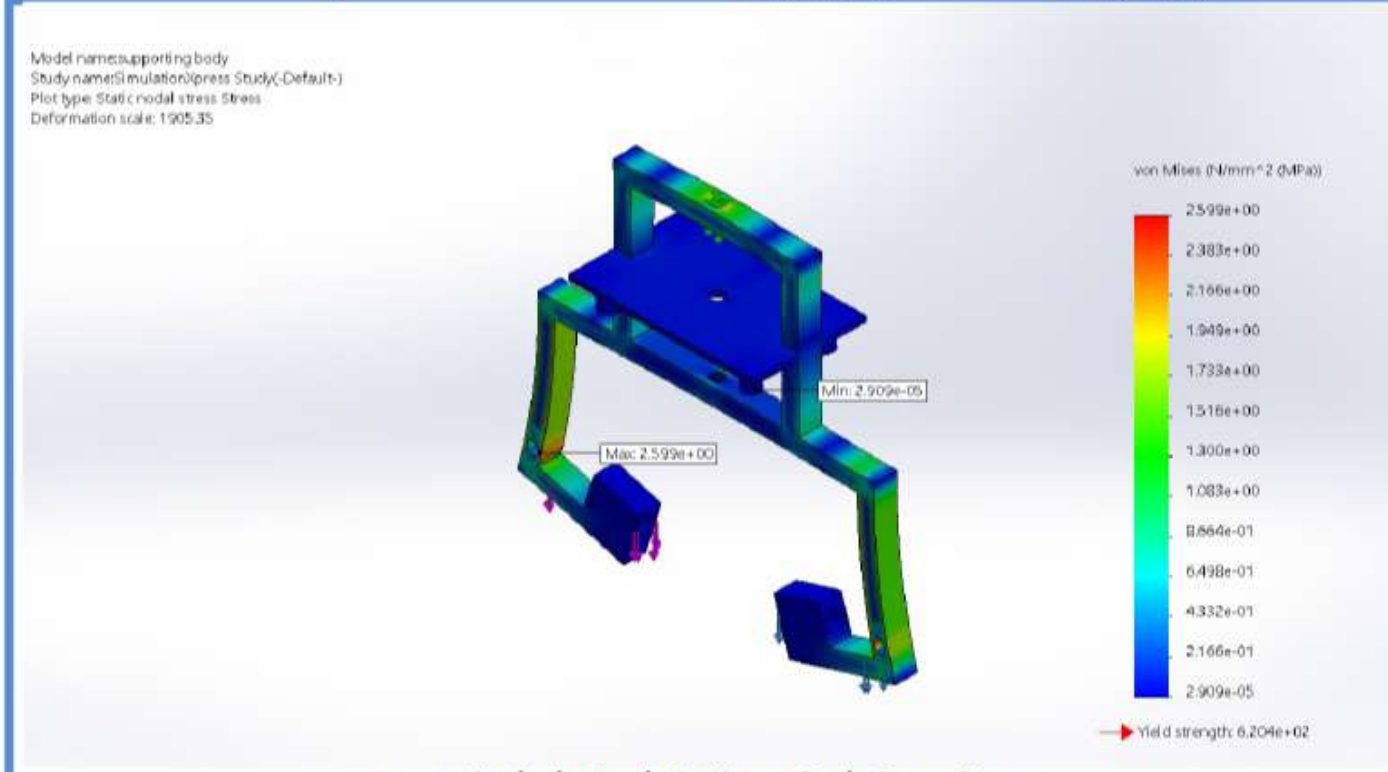
Loads and Fixtures

Fixture name	Fixture Image	Fixture Details
Fixed-1		**Entities:** 1 face(s) **Type:** Fixed Geometry

Load name	Load Image	Load Details
Force-1		**Entities:** 1 face(s) **Type:** Apply normal force **Value:** -30 N
Force-2		**Entities:** 1 face(s) **Type:** Apply normal force **Value:** -30 N

Study Results

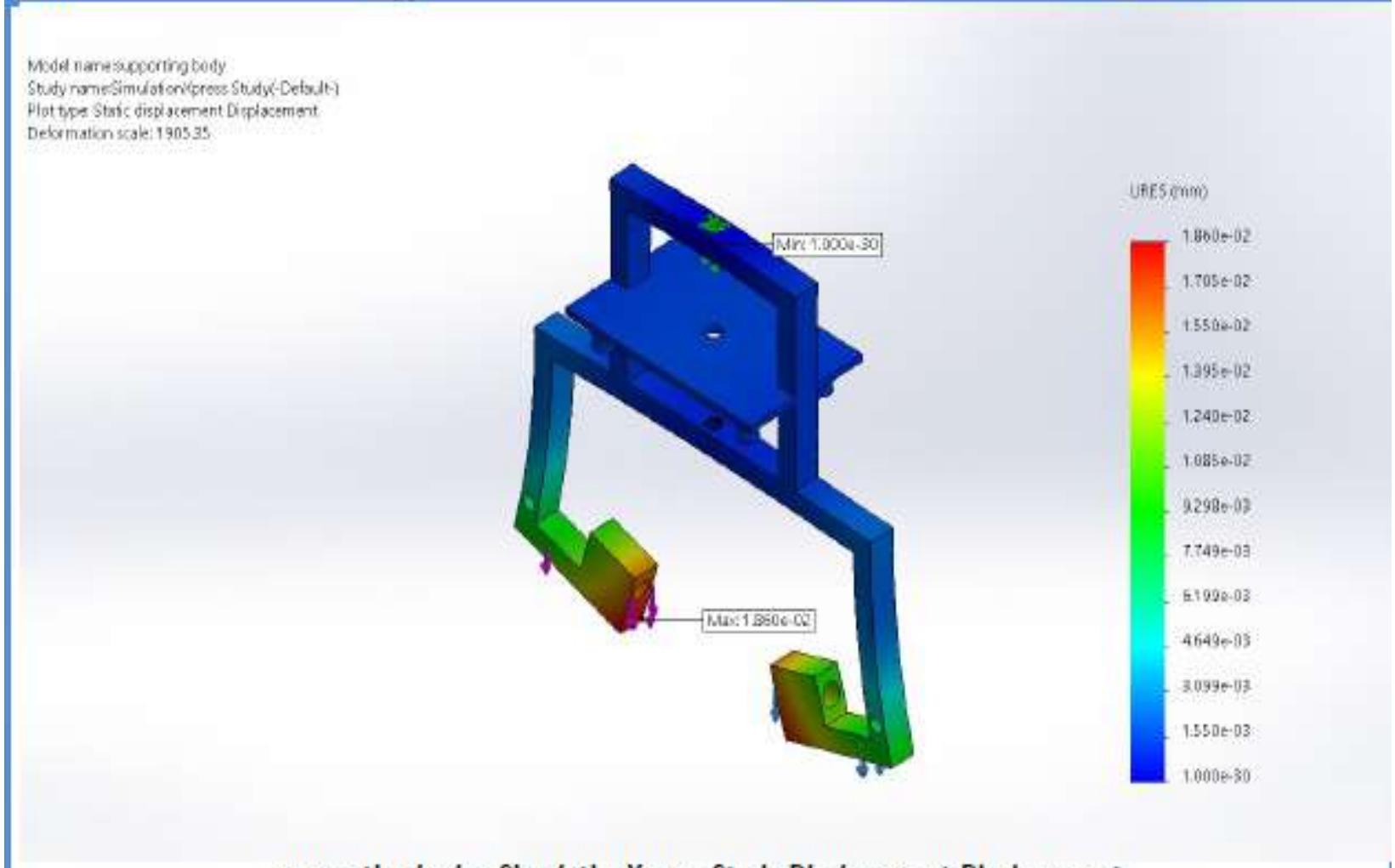
Name	Type	Min	Max
Stress	VON: von Mises Stress	2.909e-05 N/mm^2 (MPa) Node: 18727	2.599e+00 N/mm^2 (MPa) Node: 17869



supporting body-SimulationXpress Study-Stress-Stress

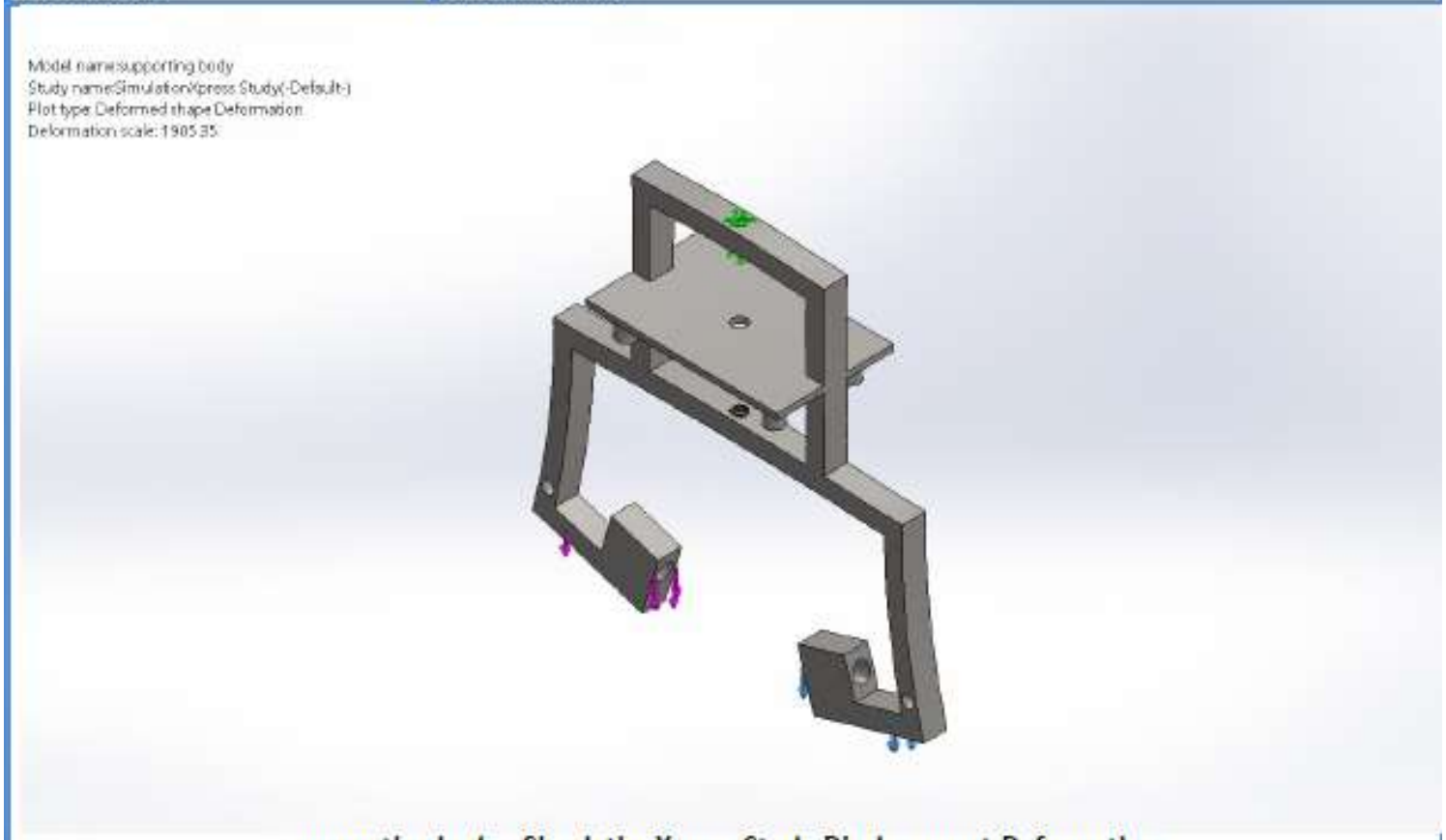
Name	Type	Min	Max
Displacement	URES: Resultant Displacement	0.000e+00 mm Node: 415	1.860e-02 mm Node: 1122

Name	Type	Min	Max



supporting body - SimulationXpress Study-Displacement-Displacement

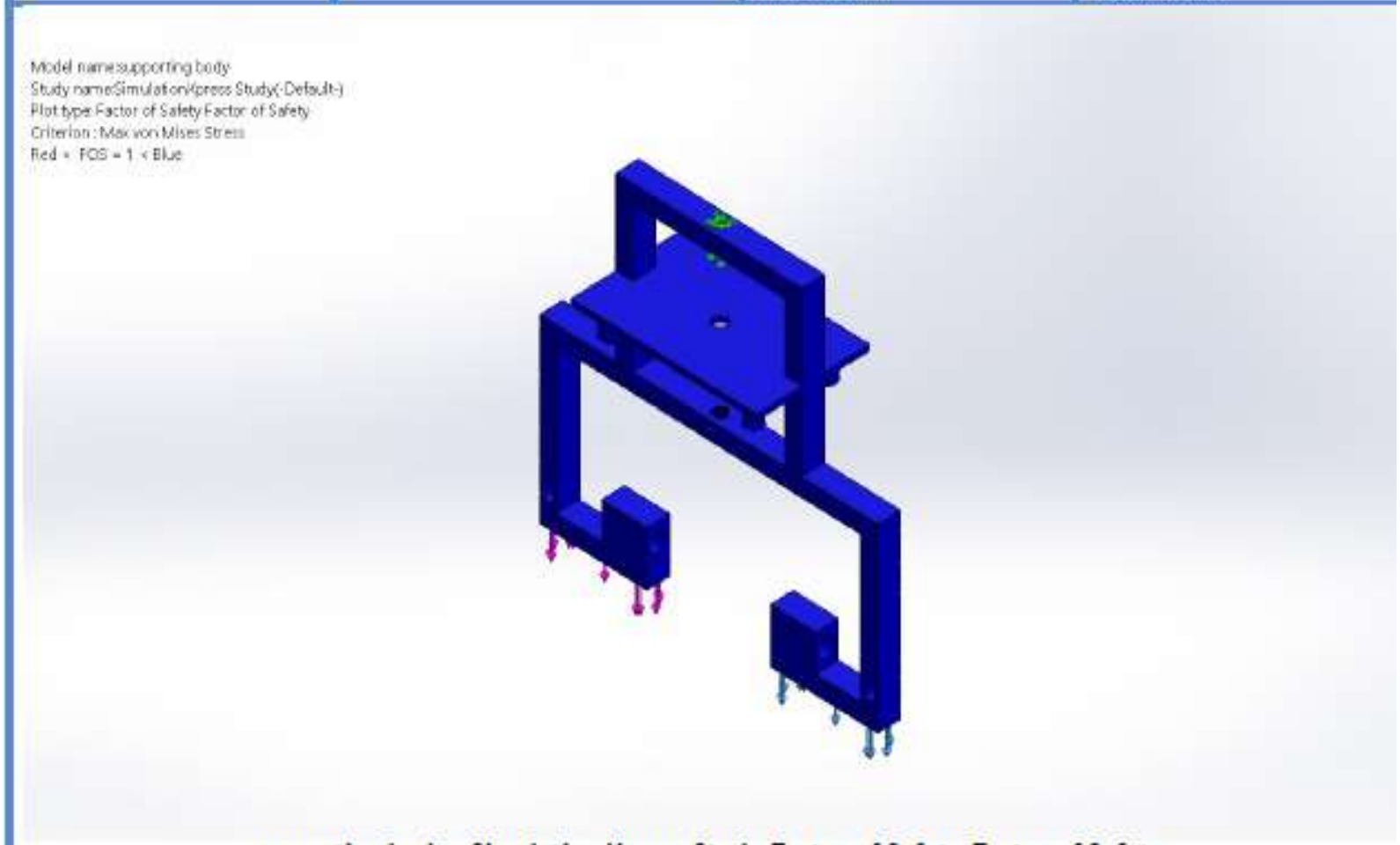
Name	Type
Deformation	Deformed shape



supporting body - SimulationXpress Study-Displacement-Deformation

Name	Type	Min	Max
Factor of Safety	Max von Mises Stress	2.387e+02	2.132e+07

Name	Type	Min	Max
		Node: 17869	Node: 18727



supporting body - Simulation Xpress Study-Factor of Safety-Factor of Safety

Conclusion: -

The life of the child who fell in bore well can be saved without wasting time and resources when this system is opted. The rescue operation carried out using this procedure will be quick and require less number of people. The cost and energy resources required will be also be reduced. The same design can be used for the pipe cleaning and inspection systems for the long vertically installed pipes when not being put to use in rescue operations. The wastage of land will be greatly brought down as the old U-shape well dug for rescuing shall not be employed.

The only demerit is that pulley system may fail in some extreme cases and operating of the system will require highly skilled person.

But, still, one demerit cannot let us overlook the overwhelming potential and usefulness of this **'Child Rescue System'.**

Thank You