MODELING, ANALYSIS AND FABRICATION OF GENEVA INDEX PLATE

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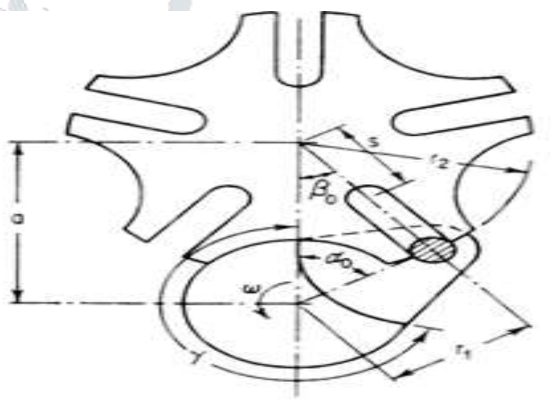
Abstract -Geneva conveyor is the new innovative concept mainly used in industries. Geneva mechanism is simple in construction and the working process is easy. In industries, it is very necessary to move the components from one place to the other, especially in automobile assembly shops we have to stop the conveyor in regular intervals in every assembly station. By using Geneva drive to stop the conveyor in regular intervals and to minimize the workers involved in it to stop the conveyor. Presently Geneva index plate made with **Aluminum alloy** material. It is used many of industries. Main drawback of this material Cannot with stand heavy loads.The solution to this may be change of material to the **stainless steel** and dimensional parameters. So, a novel model of Geneva index plate will be developed, analyzed and prototype will be prepared using to the lathe and milling machines techniques.

Keywords: -stainless steel, Aluminum alloy, lathe and milling, Analysis, prototype.

1. INTRODUCTION

So, here on this task to modeling and analysis of a Geneva index plate, consistent with the CNC techniques on milling we form the Geneva plate. In this challenge we will draw the geneva plate with references taken via the usage of CAD software program CATIA, and analysis might be performed at the CAE SOFTWARE, ANSYS WORKBENCH, according to the Geneva version we add the substances to the thing (steel and aluminum) do the evaluation with extraordinary substances on the Geneva ,to find out the stress, strain, deformation and frequency of the aspect Geneva index plate. The Geneva drive(or)Maltese pass is a equipment mechanism that interprets a continuous rotation into an intermittent rotary motion. The rotating power wheel has a pin that reaches right into a slot of the driven wheel advancing it via one step. The force wheel also has a raised round blockading disc that locks the pushed wheel in role between steps.



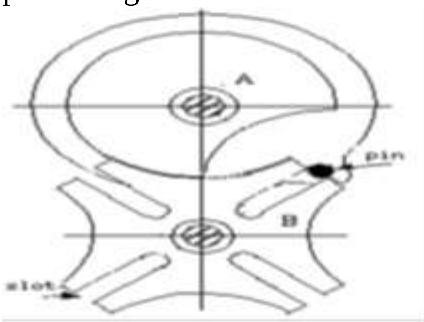
2. LITERATURE REVIEW

U.Vijaykumar, et.al(1) "The design and analysis of paper cutting machine based on Geneva whee". They Presented a comparison of the position, velocity, acceleration, and jerk between Geneva wheel mechanism and the proposed mechanism. This analysis presents a kinematic study of a mechanism incorporating a Geneva wheel and a gear train to achieve intermittent motion was declared as a designated analysis and succeeded largely due to its positive economic factors. The design and fabrication of paper cutting machine using by Geneva mechanism is useful to cut papers in equal and accurate dimension. Geneva mechanism converts continues motion to intermittent motion, Due to which paper is moved between the intervals of cutting period. Then paper cutting is achieved by crank& lever mechanism. The cutter will be back to its original position by spring effect. Thakare, Prof.D.U.Patil, et.al (2) “The Bottle filling machine based on Geneva mechanism”. The project discussed about the design and implementation of automated multiple water filling machine using Geneva mechanism. Generally, the function of the machine is to fill the water automatically into bottles through a moving bottle plate. This project is the combination of Geneva and electrical synchronous motor system. This project was divided into four sections, the loading section, the bottle plate section and filling section, where the whole sections is controlled by Geneva. The entire system is more flexible and time saving. HanJiguangYuKang, et.al (3) “The analysis and synthesis of Geneva mechanism with elliptical crank”. this project has been analyses that for both internal and external Geneva mechanism, the kinematics coefficient of the Geneva mechanism is a constant if the groove number of the Geneva wheel is a constant. The elliptic crank using as the drive crank of The elliptic wrench the utilization of as the power wrench of the Geneva wheel is indistinguishable to the component which has a variable span and a variable speed along the circular exchanging wrench. In this manner the kinematics coefficient of the Geneva instrument can be altered. In this paper the investigation strategy of the consolidated Geneva system is provided. The blend procedure of the blended Geneva instrument is prescribe in light of the kinematics coefficients. The estimation system of the extraordinary kinematics coefficient is proposed. Ankur Prajapati, Aakash Dubey,et.al (4) “Review on the geneva mechanism and its application” David B Dooner, Department of mechanical engineering, University of Puerto Rico, et.al (5)“A Intermittent motion mechanism incorporating a geneva wheel and gear train” .R.G.Fenton,Y.Zhang,et.al (6) “Development of new geneva mechanism with improved kinematic characteristics”. A.T.Yang, L.M.Hsia, et.al (7) “Multistage geared geneva mechanism”.

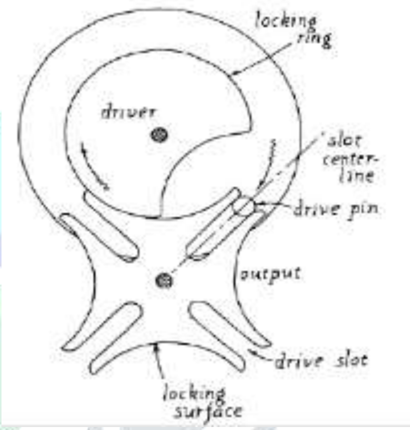
3. IMPLEMENTATION

Geneva Mechanism

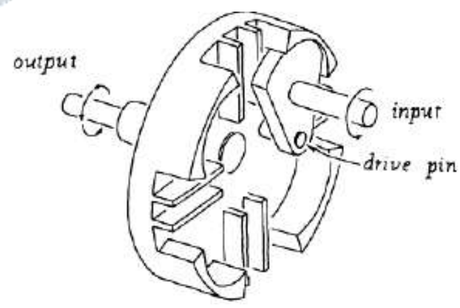
In this mechanism, for every flip of the driving force wheel A, The driven wheel B makes a quarter turn. The pin, attached to driver wheel A, movements within the slots inflicting the motion of wheel B. The contact among the lower elements of motive force A with the corresponding hollow part of wheel B keeps it in role while the pin is out of the slot. Wheel A is reduce away close to pin as proven, to be able to provide clearance for wheel B because it movements. If any one of the slot is closed, A could make much less than one revolution in both direction before the pin moves the closed slot and preventing the movement.



External Geneva Mechanism: This type of mechanism, the Geneva go is attached with cam force externally which is the maximum popular and which is represented by means of the device



Internal Geneva Mechanism: This kind of mechanism, the Geneva move and cam pressure are related internally inside the closed box, which is also common and is illustrated



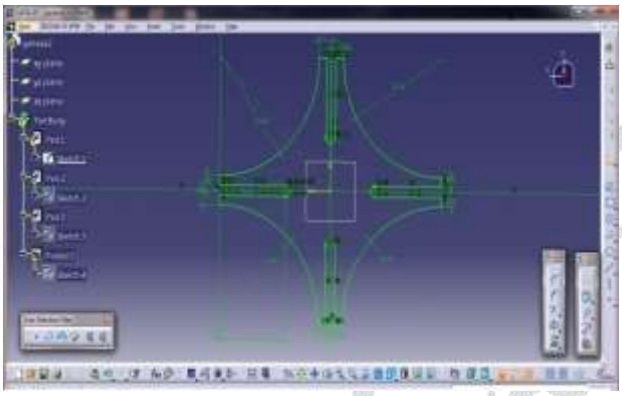
Spherical Geneva Mechanism: This kind of mechanism the Geneva pass is in spherical form and cam drives are connected in externally, that is extremely rare and is illustrated.

4. EXPERIMENTAL RESULTS

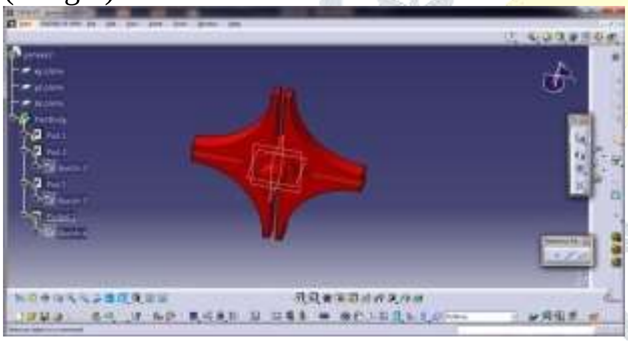
Here by using CATIA software develop the Geneva index plate and Geneva drive.

Geneva index plate

draw the sketch as per the specifications, Select required plane – select sketch tool, it enters into sketch module now draw the required sketch. To create the small ends. draw the sketch shown below with required dimensions and exit workbench.

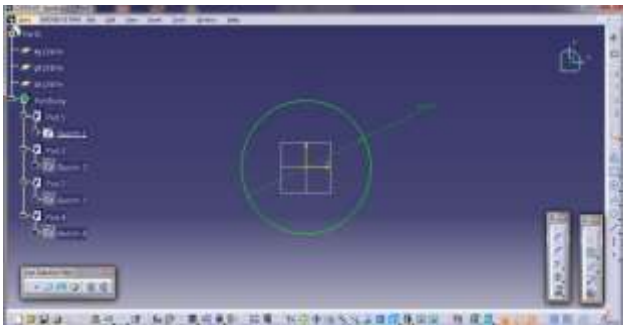


It is selected from the sketch based feature. This feature is used to add the material normal to sketch or through a reference. In this part design use padding tool from the sketch based features and select the sketch then give the required height (Length).

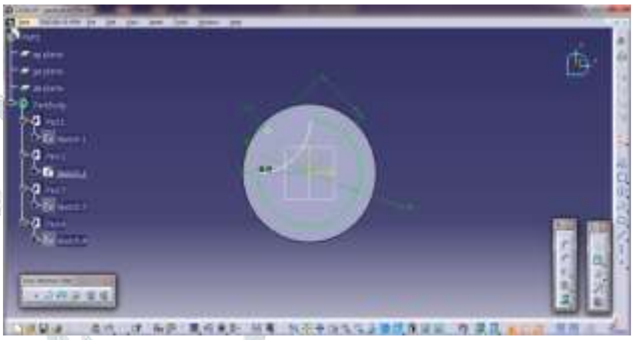


Geneva drive plate

To draw the sketch as per the specifications, Select required plane – select sketch tool, it enters into sketch module now draw the required sketch. To create the small ends. draw the sketch as shown below with required dimensions and exit workbench.

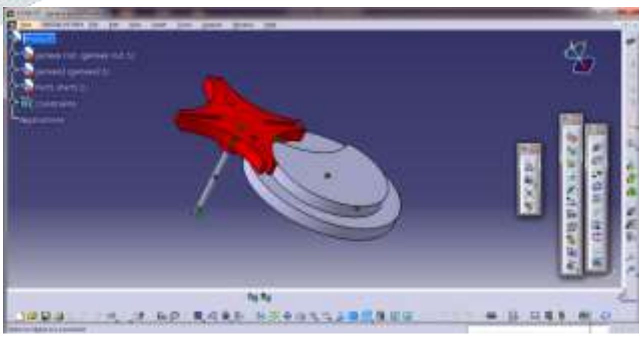


The part design use pad tool from the sketch based features and select the sketch then give the required height (Length).



Assembly of Geneva indexing and drive

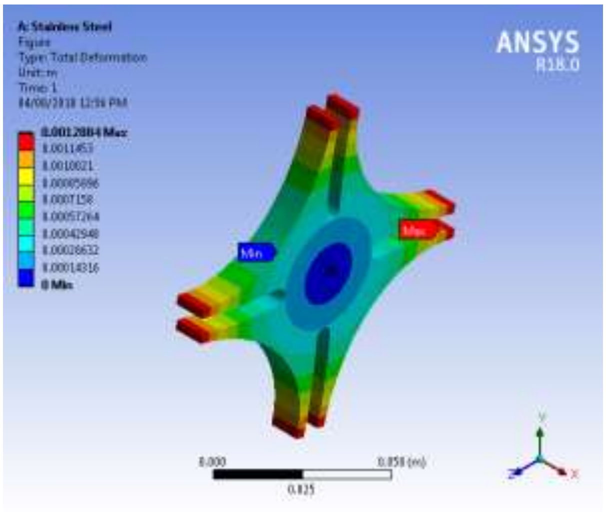
The Geneva index plate and drive plate assembly together by using geometry constraints in CATIA software.



5. RESULTS AND DISCUSSION

Total deformation for stainless steel

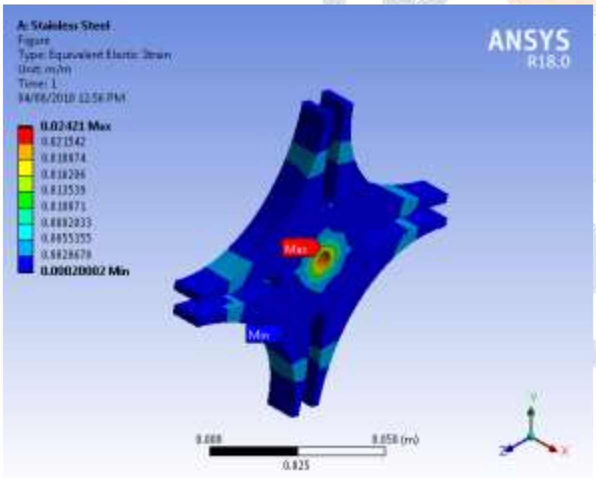
Time [s]	Minimum [m]	Maximum [m]
1.	0.	1.2884e-003



Here shown fig. is total deformation of stainless steel. The index plate varying different colours. The blue colour was minimum deformation, red colour as maximum deformation. The maximum deformation is upper side, minimum deformation is lower side.

Equivalent elastic strain for stainless steel

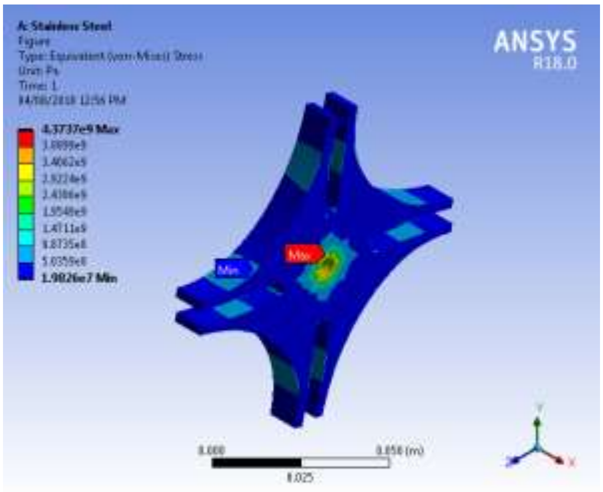
Ti [s]	Minimum [m	Maximum [m
1.	2.0002e-004	2.421e-002



Here shown fig. is Equivalent elastic strain of stainless steel. The index plate varying different colours in different places of plate. The out side of plate minimum strain shown. as blue colour. The inner side of plate is maximum elastic strain as shown red colour.

Equivalent stress for stainless steel

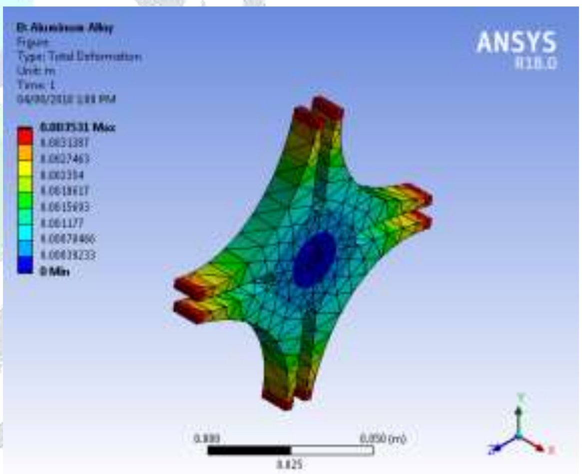
Time [s]	Minimum [Pa]	Maximum [Pa]
1.	1.9826e+007	4.3737e+009



Here shown fig. is Equivalent stress of stainless steel. The index plate varying different colours in different places of plate. The out side of plate minimum stress shown as blue colour. The inner side of plate is maximum stress as shown red colour.

Total deformation for Aluminum

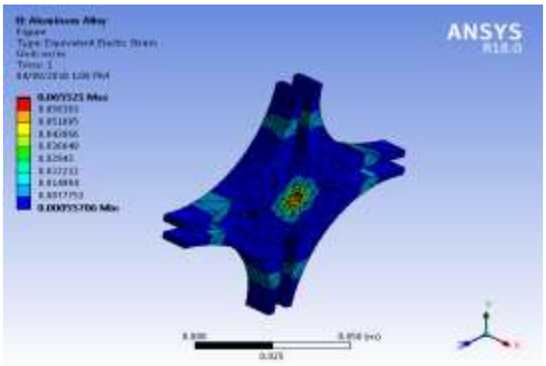
Time [s]	Minimum [m]	Maximum [m]
1.	0.	3.531e-003



Here shown fig. is total deformation of aluminum alloy. The index plate varying different colours. The blue colour was minimum deformation, red colour as maximum deformation. The maximum deformation is upper side, minimum deformation is lower side.

Equivalent elastic strain for stainless steel

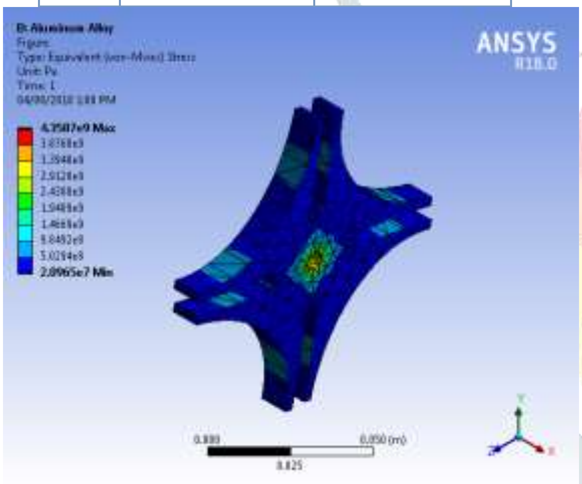
Tim [s]	Minimum [m/m]	Maximum [m/m]
1.	5.5706e-0(	6.5521e-0(



Here shown fig. is Equivalent elastic strain of aluminum alloy by applying static load. The index plate varying different colours in different places of plate. The out side of plate minimum strain shown as blue colour. The inner side of plate is maximum elastic strain as shown red colour.

Equivalent stress for stainless steel

Ti [s	Minimum [Pa]	Maximum [Pa]
1.	2.0965e+0	4.3587e+0

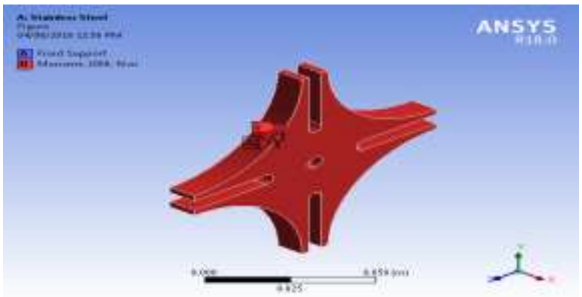


Here shown fig. is Equivalent stress of aluminum alloy. The index plate varying different colours in different places of plate. The out side of plate minimum stress shown as blue colour. The inner side of plate is maximum stress as shown red colour.

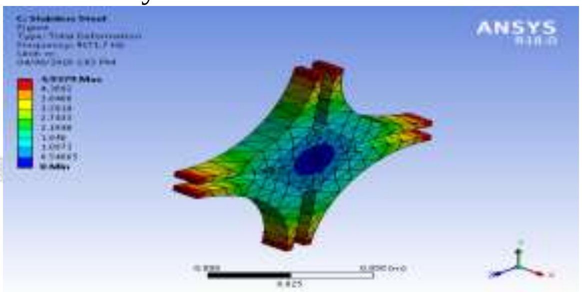
Model analysis

Model analysis of stainless steel

Model analysis use to determine (or) use to study the response of structure for dynamic loading(N-M).This case initial conditions are fixed point, material and dynamic load. As per speed of index plate ANSYS was calculate modes of frequency.

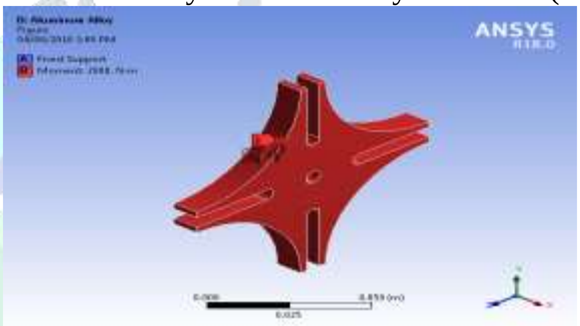


Each mode of frequency, structure was deform different shapes. Here stainless steel was used in model analysis.

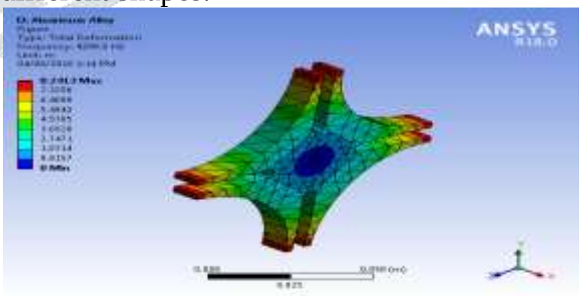


Model analysis of aluminum alloy

In this case initial condition are fixed point, aluminum alloy material and dynamic load(N-M).



As per speed of index plate ANSYS software calculated the modes of frequency. The each mode of frequency, the structure was deform different shapes.



6. FABRICATION

Fabrication of Geneva index plate

The fabrication of Geneva mechanism as following steps

Step-1 First take raw material(stainless steel EN8) for the both geneve index plate and drive.

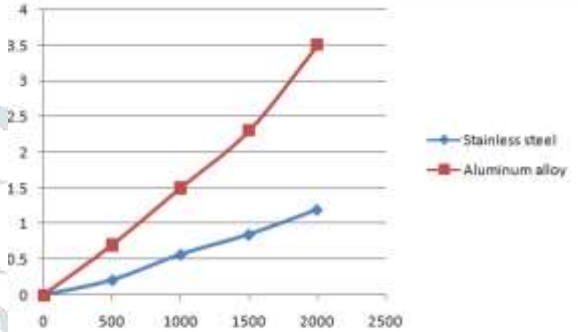
Step-2 The raw material was finishing with lathe operation. like the turning and facing operation on the lathe machine with required dimensions. After facing operation follow the step turning operation and chamfering operation.

Step-3 After lathe operation, we need marking the work piece for milling operation. In these case we used the Rotary indexing machine and jig boring machine for the marking. By using the marking tools, make the angle of cut and depth of cut etc.

Step-4 The marking work piece further doing milling operation. In these case single point cutting tool will used in operation. After milling operation, chamfering will done on the another tool in milling machine. The final mechanism was formed below fig.

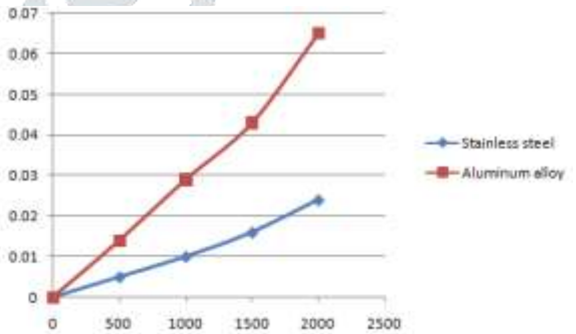
7. GRAPHS

Load vs Total Deformation



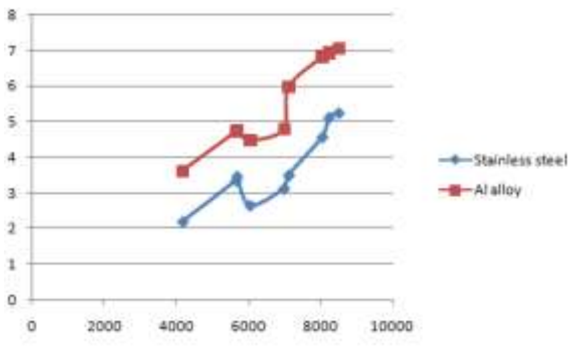
Here the Load vs Total deformation graph plotted. load is taken as X-Axis and total deformation is taken in Y-Axis. In this graph Venetian red is aluminum alloy and peacock blue is stainless steel. The total deformation of the stainless steel better then the aluminum because of lower deform value.

Load vs Equivalent Elastic Strain



Here the Load vs Equivalent elastic strain graph plotted. load is taken as X-Axis and Equivalent elastic strain is taken in Y-Axis. In this graph Venetian red is aluminum alloy and peacock blue is stainless steel. The Equivalent elastic strain of stainless steel better then the aluminum because of lower strain value.

Frequency vs Total Deformation in model analysis



The Geneva index plate working under vibrations. The vibration was depending upon the frequency and time. So here we are done the model analysis by using 10 different frequencies. The graph shown as the X-Axis is frequency and Y-Axis total deformation. The aluminum alloy is the greater deformation as compare to the stainless steel material.

8. CONCLUSION

	Stainless Steel	Aluminium Alloy
Total Deformation	0.0012884	0.003531
Equivalent Elastic Strain	0.02421	0.065521
Equivalent Stress	4.37E+09	4.36E+09

Hence from the above results, Stainless Steel has the less deformation when compared to that aluminum alloy material, the strain is less in Stainless Steel when compared to that aluminum alloy material, the stress is less in case of the Aluminum Alloy. Hence Stainless Steel is the best to manufacture the Geneva index plate for conveyor used in medium size industry.

9. REFERENCES

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