

DESIGN AND ANALYSIS MATERIAL HANDLING SYSTEM USING KINEMATIC MECHANISM

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Abstract - The main motive of this project is to replace conventional conveyor systems by fully mechanical highly efficient and low maintenance system and mainly focused towards small scale industries to automate the material handling process. In this project work is done by converting rotary motion into reciprocating motion by Double crank mechanism. This work is solely based on link and kinematic mechanism and with use of motor whose rotary motion is converted to reciprocating motion. This will surely reduce the efforts for small scale industries and helps to increase its productivity.

Key Words: double crank mechanism, motor, reciprocating motion, conveyor systems

1 INTRODUCTION

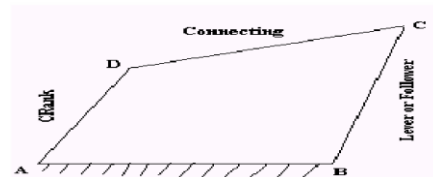
The need of moving the manufactured components of any industrial plant is one of the basic needs that need to be fulfilled in order to ensure the efficiency of the plant as a whole. There are various prototypes dedicated solely for the in-plant transport of components or totally manufactured final products. But the thing which does not comply with most of the conveyor belt systems is that they are not cost efficient and does not promote intermittent motion unless it is programmed also it requires a large amount of capital investment and not available at affordable prices notably for small scale industries. The remarkable advantage of this project is that it provides intermittent/sporadic motion with time delay. Conventional system is not equipped with this type of sporadic motion unless they are programmed to stop at a designated stop which again increases the cost. In Industry there has been a serious demand for intermittent movement of packages /products project right from the start. The continuous motion is less important than sporadic motion, hence the main firm of the is to produce a

mechanism that delivers this stop and move motion using mechanical linkages. The advantages of this system is that the system has a time delay between moving packages/products, while in conveyor system such actions cannot be performed unless the programmed module is used to produce intermittent stopping hence this time delay helps in providing value addition for a product.

2 LITERATURE SURVEY

FOUR BAR MECANISM

The mechanism is composed of rigid bodies which are connected to form linkages. Four bar mechanism consists of three moving links, one fixed links and four pin points. Generally, when the links move in parallel planes then the assembly is called as planar four-bar linkages. The link moves in concentric spheres when the axes of the hinged joints are set in an angle where their axes intersect.



INVERSIONS OF FOUR BAR MECHANISM

Inversion of Four bar Mechanism The traditional definition of mechanism basically sums up as where there is a link which is fixed and the other links are moving then it is a mechanism. In four bar different mechanism can be obtained when we adjust the intersecting paths of the axes of the linkages. These are called as inversions of the mechanism. By changing the fixed link, the number of mechanisms which can be obtained is equal to the number of links. Therefore except the original mechanism, all other mechanisms are inversions of original mechanism. Functions of linkages Obviously the function of any link mechanism is to produce rotating, oscillating or reciprocating motion from the rotation of crank or vice versa.

Linkage functions are to provide relative motion, Path generation: path of the tracer point and Motion generation: motion of coupler link.

DOUBLE CRANK MECHANISM

Double crank mechanism one of the inversions of four bar chain mechanism is used for the development of this project, where link 1 is fixed the link 2 and 4 will rotate and link 3 will oscillate. This inversion having major advantage that its two of the links will rotate and hence called as Double crank mechanism.

GRASHOFF'S LAW

Grashoff's Law state that for a planer four bar linkage, the sum of the shortest and the longest link length cannot be greater than sum of the remaining two link length, if there is a continuous relative motion between the members. It is important to note that in four bar mechanism if none of the link make a complete revolution then it is not useful in practical application, hence it is necessary that one of the link must be revolving link. With the help of Grashoff's Law, it can be easily tested that whether any link can make complete revolution or not.

$$S + L < P + Q$$

where:

S = length of shortest bar

L = length of longest bar

P, Q = lengths of intermediate bar

3 MAIN COMPONENTS USED

3.1 Linkages

A mechanical linkage is an assembly of bodies connected to manage forces and movement. The movement of a body, or link, is studied using geometry so the link is considered to be rigid. The connections between links are modelled as providing ideal movement, pure rotation or sliding for example, and are called joints. A linkage modelled as a network of rigid links and ideal joints is called a kinematic chain. Linkages may be constructed from open chains, closed chains, or a combination of open and closed chains. Each link in a chain is connected by a joint to one or more other links. Thus, a kinematic chain can be modelled as a graph in which the links are paths and the joints are vertices, which is called a linkage graph. The movement of an ideal joint is generally

associated with a subgroup of the group of Euclidean displacements. The number of parameters in the subgroup is called the degrees of freedom (DOF) of the joint. Mechanical linkages are usually designed to transform a given input force and movement into a desired output force and movement. The ratio of the input speed to the output speed is known as the speed ratio.

3.2 Dc motor

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. A windscreen wiper or windshield wiper is a device used to remove rain and debris from a windscreen or windshield. Almost all motor vehicles, including trains, watercraft and some aircraft, are equipped with such wipers, which are usually a legal requirement. A wiper generally consists of an arm, pivoting at one end and with a long rubber blade attached to the other. The blade is swung back and forth over the glass, pushing water from its surface. The speed is normally adjustable, with several continuous speeds and often one or more "intermittent" settings. Most automobiles use two synchronized radial type arms, while many commercial vehicles use one or more pantograph arms.



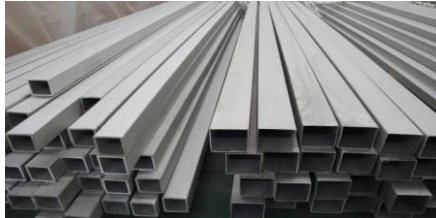
3.3 DC battery

A battery is a device that can create electricity using a chemical reaction. It converts energy stored in molecules inside the battery into electricity. They produce direct current (DC) electricity (electricity that flows in one direction, and does not switch back and forth). Using the electricity from an outlet in a house or building is cheaper and uses less energy, but a battery can provide electricity in areas that do not have electric



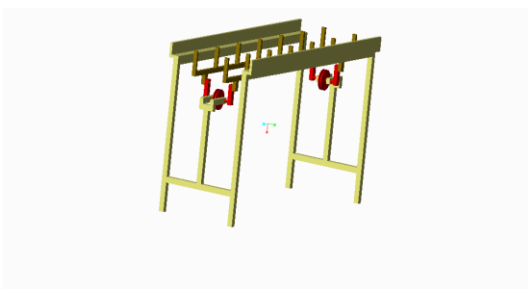
3.4 Steel Frame

Steel frame is a building technique with a "skeleton frame" of vertical steel columns and horizontal I-beams, constructed in a rectangular grid to support the functioning/motion links and provides rigidity.



4 DESIGN OF PROJECT WORK

We have used CREO software to design our project, and the final design is as follows



PROCEDURE

1. First of all we have prepared design for the material transfer machine
2. We took the iron angles and cut them in to the required measurements using the cutting machine.
3. Then we took them and welded those to produce frame for the material transfer system.
4. After making the welding of iron angles the frame for the machine was ready.
5. Then we have used wood to make links for the mechanism ,we took wooden repars and cutted them into the required dimensions.
6. After preparing the shaft, hanger and crank we take it over the drill machine to make the holes in them as the given dimension in the drawing.
7. After this we had prepared the shaft which is going move the boxes to the next level with using it edges on the top of it.

We cut the mild sheet plate in the given dimensions and then edges also, after cutting we make the welding to attach these edges with the plate on the given distance dimensions. Then with the help of file we rub these welding points to give them a good look.

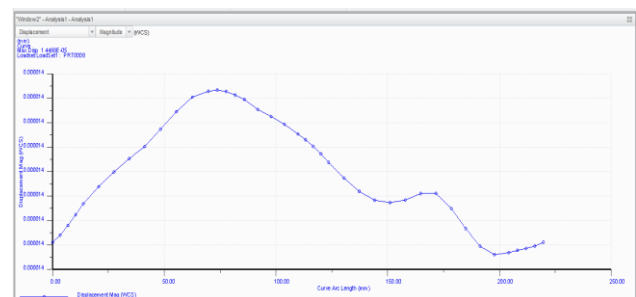
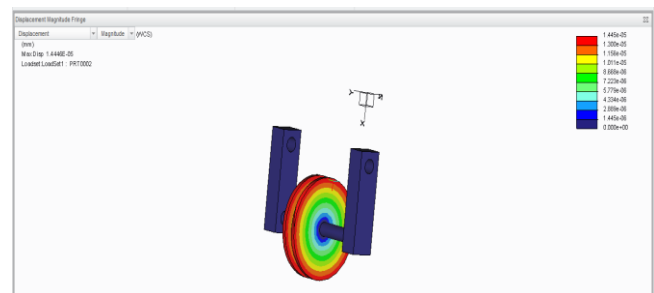
8. Now all of the things for the machine are prepared.

9. On this step we took the electric motor and fix that on the bed of the machine on the given place.

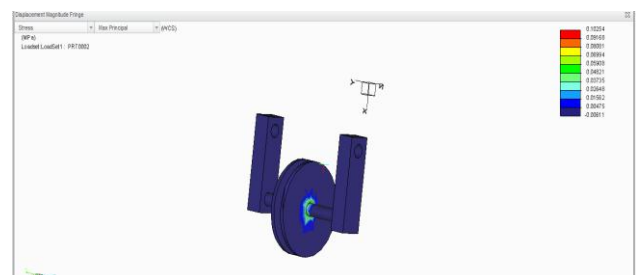
10. After fixing the motor we fixed the crank with it from one side and other side was attached to the

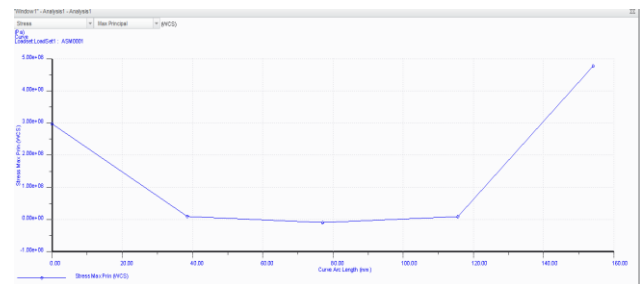
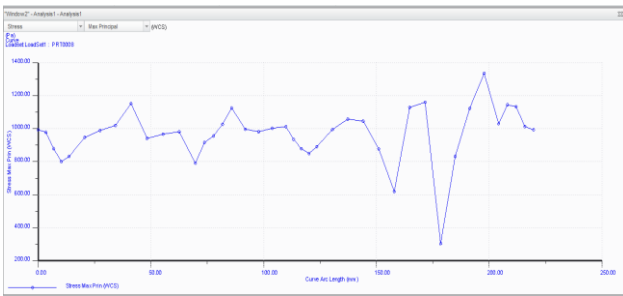
5 ANSYS RESULT IMAGES

CRANK-Analysis for displacement



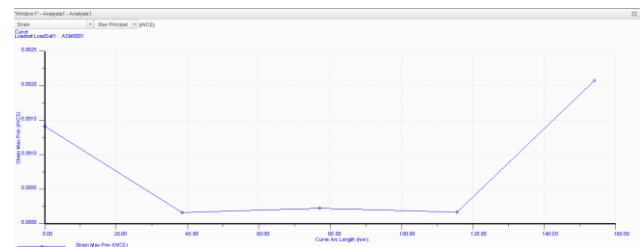
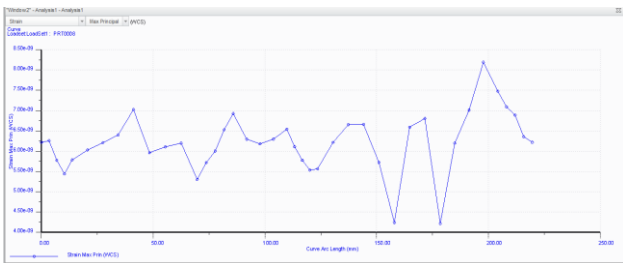
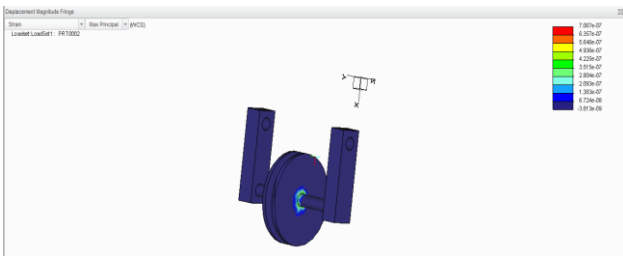
CRANK-Analysis for stress





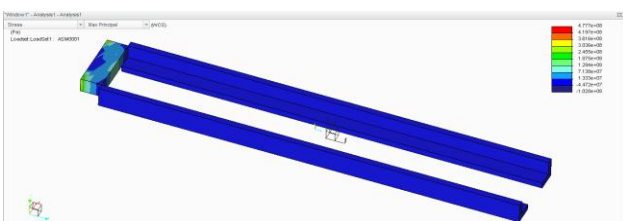
CRANK-Analysis for strain

SLIDER-Analysis for strain



SLIDER-Analysis for stress

6 CONCLUSION



The material handling system plays a major role in industries, the process of transporting or shifting products from one place to another was to be maintained by conveyors only. So we just successfully altered this with a box shifting mechanism using the kinematics links and a motor. We had just implemented our basic mechanical knowledge and designing skills for designing and fabricating this project successfully. Thus this project work might be useful in all industries. For practical applications this is

fabricated for light duty operation. Its height, weight and other mechanical designs may be not suitable for any other heavy operation or work on hardened material. We are proud that we have completed the work with the limited time successfully. The project works with satisfactory conditions.

7 REFERENCES

[1] Professor, Dept. of Mechanical Engineering, Gnanamani College of Technology, Namakkal A Review on Kinematic and Dynamic Analysis of Mechanism” by Shrikant R. Patel, D. S. Patel, B. D. Patel Research Scholar, Associate Professor, Assistant Professor.

[2] E. Tanik, “Transmission angle in compliant slider-crank mechanism,” Mechanism and Machine Theory, vol. 46, pp. 1623– 1632, 2011.

[3]<http://www.mekanizmalar.com/transport01.html>

[4]<http://projectseminars.org/report-box-transportmechanism-project-report-in-pdf>

[4] <http://seminarprojects.com/s/box-transport-mechanism>

[7]<https://www.slideshare.net/awadheshyadav1/boxtransport-mechanism-70471222>

[8]<https://www.scribd.com/doc/265843574/Box-Transport-Mechanism>.