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DESIGN AND STRUCTURAL ANALYSIS OF A UNIVERSAL JOINT

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ABSTRACT

A joint or a coupling during a rigid rod that permits the rod to bend in any direction is universal joint. The aim of universal is to transfer force from one plane to a different, retentive no matter motion energy applied to the shaft.Manly the vehicles and trucks create use of those universal joints. It consists of 2 shaft yokes at right angles to every different and 4 points cross that connects the yokes. The cross rides are ironed into the yoke eyes within the bearing assemblies. These ar operated endlessly and with high force masses in Industries. thus these joint partsought to have long life and most strength. fashionable universal joints became additional advanced than older ones.

The modeling of universal is finished in CATIA and analysis is finished in ANSYS.

I. INTRODUCTION

A joint or coupling that permits elements of a machine not in line with one another restricted freedom of movement in any direction whereas transmittal motion. Additionally referred to as universal coupling.

1.1 Definition

A joint that transmits motion between 2 shafts that are not during a line. counting on its style, a universal will accommodate an oversized angular variation between its inputs and outputs. the only quite universal, referred to as a "Hooke joint," causes the output shaft to hurry up and weigh down double for each revolution of the input shaft. This speed fluctuation will increase with the angular distinction between the shafts. Another, additional common, name for a Cardan joint.

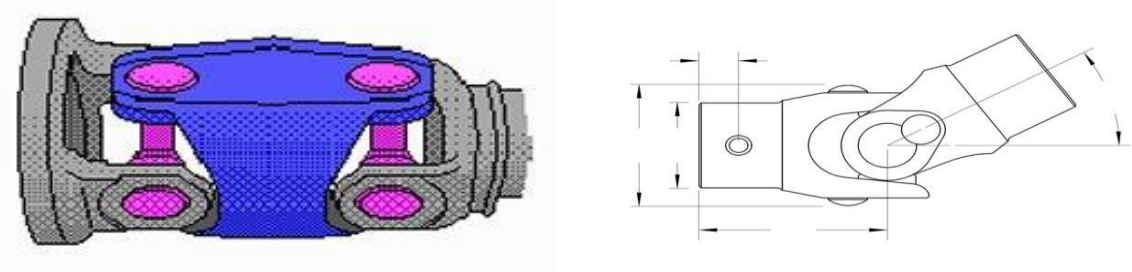

Figure1. 1

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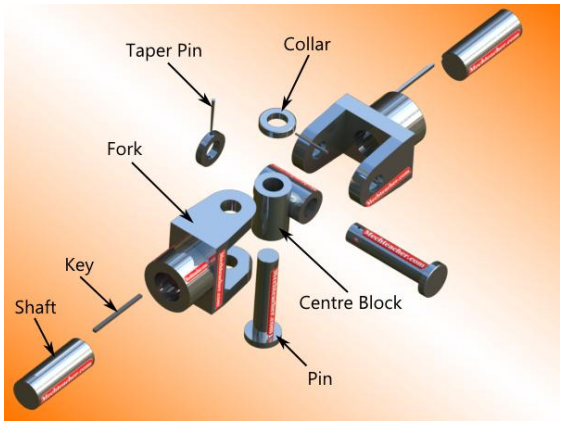
Between 1700 and 1800, little or no is recorded within the method of furtherdevelopments in versatile couplings. the economic Revolution andespecially, later, the car revolution precipitated the creation ofmany versatile couplings. In 1886, F. Roots theorized that if he thinneddown the projection section of a rigid coupling it'd flex and forestall theequipment and shaft from failing, a concept that was the forerunner oftoday's diaphragm coupling. The Davis compression coupling was developed to eliminate keys by compressinghubs onto the shaft. it absolutely was thought to be safer than different couplingdevices as a result of no sticking out screws were needed, what's believedto be the primary chain coupling



Parts of a Universal Joint

A typical universal joint consists of the following parts:

1. Centre block
2. Fork
3. Pin
4. Collar
5. Taper Pin

The following two parts are not integral to a universal joint. But they are required to complete the assembly of the joint.

1. Shaft
2. Shaft Key

All parts are discussed in detail below.

1.1.1 Centre Block

Centre block is the basic building block of a universal joint. It provides support to the forks used in the joint. It consists of two hollow cylinders joined together at right angles to each other. Holes in the centre block are meant to accommodate pins.

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1.1.2 Fork

Two Forks are used for providing support to the shafts that are to be connected using the universal joint.

A typical fork consists of a central hole to support shaft and a keyway to accommodate shaft key. It also contains two holes to support a pin. Forks are designed in such a manner that they fit accurately over the centre block.

1.1.3 Pin

It is a component used for securing the fork to the centre block. It contains a tapered hole to accommodate a taper pin. In a universal joint, two pins are used to connect two forks to the centre block.

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1.1.4 Collar

It is used for securing the location of the pin that is inserted into the fork. It contains tapered holes to accommodate taper pin. In a universal joint, two collars are used to secure two pins.

1.1.5 Decrease Pin

It holds the stick and neckline in the craved area. It keeps the stick from pivoting or moving. This guarantees the unbending nature of the widespread joint. A picture of a decrease stick is demonstrated as follows:

1.1.6 Shaft

Shaft is the pivoting machine component that will be associated by the all inclusive joint. It is barrel shaped fit as a fiddle. It contains a keyway to suit shaft key. You can comprehend this by investigating the accompanying picture:

1.1.7 Shaft Key

It is utilized to make the all inclusive joint pivot with the pole. It makes the pole to legitimately fit itself in the widespread joint. Shaft key may be straight or decreased.

Focal points of Universal Joint:

Truly, pivoting gear was initially associated by method for unbending spines Experience shows that this technique did not oblige the movements and outings experienced by the hardware.

As talked about in Chapter 1 , F. Roots was the first to thin these ribs and permit them to flex. Inflexible couplings are utilized to associate gear that encounters little shaft trips or with shafts made long and sufficiently thin that they can acknowledge powers and minutes created from flexing ribs and shafts. Adaptable couplings join two bits of pivoting gear while

allowing some level of misalignment or end development or both. The three fundamental elements of an adaptable coupling are to

1. Transmit control
2. Oblige misalignment
3. Adjust for end development

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II. INTRODUCTION TO CATIA

CATIA is a completely computerization programming which relates with the mechanical field. It is graphical UI which is anything but difficult to learn furthermore the product is highlight based and parametric strong demonstrating. We can draw 2D and 3D models of a section and in like manner the gathering of the parts should be possible in it.

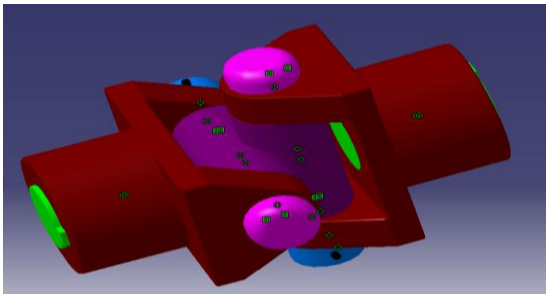
The shape or geometry of the model or get together is needy upon the qualities which are alluded as imperatives. Modules, for example, sketcher module used to outline 2D drawings, part plan module is utilized to outline the 3D models of geometry, and Assembly work configuration is utilized to gather the distinctive parts which are attracted the part plan module. Kinematics is utilized to give the recreation or movement to the part bodies which are composed and gathered to some extent and get together plan modules.

Distinctive modules utilized as a part of CATIA

- Sketcher
- Part Design
- Assembly Design
- Kinematics

By Using the CATIA programming the part plans were planned and get together is made on the grounds that contrasted with other programming's CATIA is anything but difficult to outline.

III. UNIVERSAL JOINT



IV. ANALYSIS

FINITE ELEMENT ANALYSIS (FEA)

The essential thought in FEA is that the body or structure might be isolated into smaller segments of limited estimations called "Limited Elements". The first body or the structure is then considered as a variety of these segments related at a predetermined number of joints called "center points". Clear limits are approximated the evacuations over every constrained segment. Such acknowledged limits are called "shape limits". This will imply the development inside the parts similar to the movement at the center points of the segments.

The Finite Element technique is a logical apparatus for settling standard and fractional differential correlation in light of the reality it is a numerical device, it can deal with the unpredictable issue that can be meant in differential scientific explanation from. The utilization of FEM is boundless as regards the game plan of

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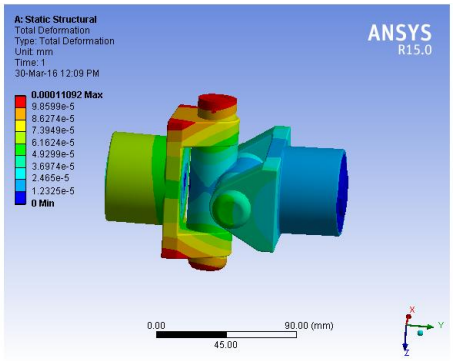
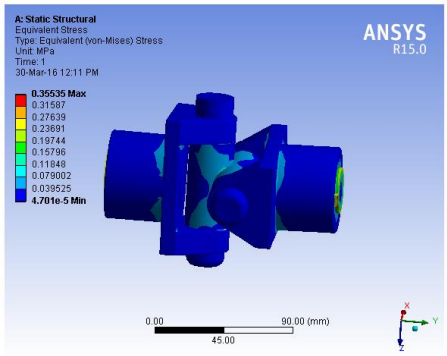
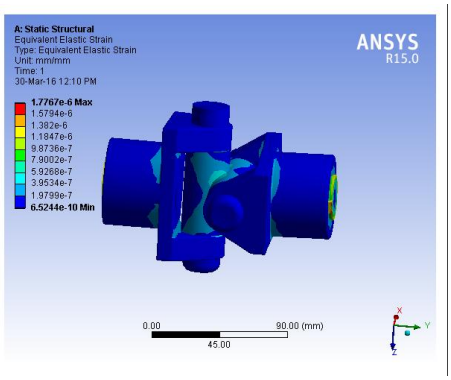
practical outline issues. Due to high cost of handling force of years cruised by, FEM has a background marked by being used to deal with complex and cost basic challenges.

V. RESULT

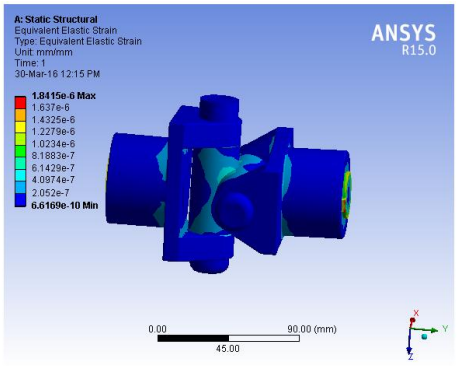
Structural steel

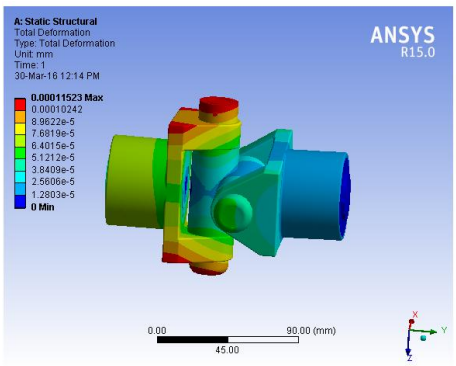


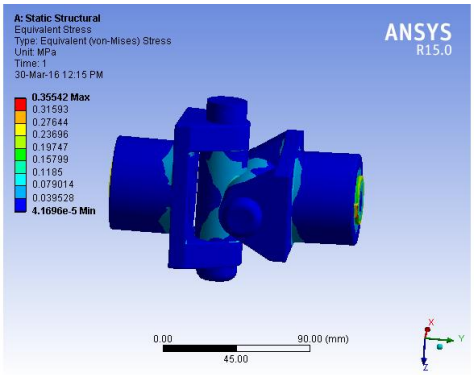




Stainless Steel







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Result

Material	Total deformation	Equivalent stress	Equivalent strain
Structural steel	0.00011092mm	0.35535MPa	1.7767e-6
Stainless steel	0.00011523mm	0.35542MPa	1.8415e-6

VI. CONCLUSION

In this project we have designed the part diagrams of the universal joint and made the assembly of these components. We have designed the part design in 2D and 3D models and assembled it in the assembly design workbench. Structural analysis has been performed on the universal joint to find the defects in the formation of universal joint. Analysis was done by considering the two different materials structural steel and stainless steel has found to be having more deformation while compared to others. Structural steel is good material for this design

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