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DESIGN AND ANALYSIS OF GEARLESS TRANSMISSION THROUGH ELBOW MECHANISM

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ABSTRACT

This paper represents the study of gearless elbow mechanism which is an equipment in alternate to bevel gear used for transmitting power between the two shafts placed at an angle between 0 – 120 degree. Mechanism consists of elbow rods and hubs which are coupled together by placing the rods in the holes that are drilled in the hubs. The mechanism is to be analysed in ANSYS package software to watch the response of the mechanism. The static structural analysis is to be carried for the mechanism having 4,6,8 pins and by applying different materials (mild steel and stainless steel) on elbow rods and hubs. Theoretical calculations are made to obtain allowable stress using design data values. As a result response of the mechanism is investigated to find suitable no of rods, material and permissible speed of the mechanism.

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I. INTRODUCTION

In today's world energy is the prime requirement in each and every field. As the world is progressing towards the 22nd century every bit of energy becomes crucial because the resources that we have for producing energy is very limited and soon will be getting finished. For transmitting motion and power from one shaft to another which are non parallel or intersecting and co- planar bevel gearing are generally employed. But there are some inherent disadvantages associated with bevel gearing stated as complexity in manufacturing, high cost of replacement. To overcome all these difficulties we have a mechanism which transmits motion between the two non-parallel (intersecting) and co- planar shafts. The mechanism is known as Gearless elbow mechanism is equipment consisting of elbow rods, hub and shaft. Gearless elbow mechanism works on the principle of slider and kinematic chain principle.

Bevel gears are generally used for transmission through non parallel shafts and worm and worm wheel and crossed helical gears are used for transmission through non parallel non intersecting shafts. This gears are costly to manufacture and come in standardized specifications thus limiting the flexibility of its application. [3] So here we introduce gearless transmission mechanism which can transmit at any angle from 0 to 1800. The mechanism of made of input and output hubs with axial holes drilled along a p.c.d and circular links bent at the angle between two shafts.so for a non-standard angle between shafts; only the angle of the links needs to be changed whereas the whole gear is needed to be redesigned in case of bevel gears. This reduces the cost of this mechanism drastically and also increases its flexibility.

II. SYSTEM STUDY

We have fabricated 4 pins gearless elbow mechanism. Gearless elbow mechanism is portable and compact equipment. Mechanism consists of 2 hubs,

4 elbow rods, 2 shafts, motor (A.C. motor 1hp), Belt drive. The motor and belt drive is coupled to the end of any one shaft. As the power is supplied to the shaft from the motor through belt drive the shaft rotates along with hub, the elbow rods placed in the holes of the hub slides in and out of both the hubs due to this the power from one shaft is transmitted to the another.

Fig 1. Structure model

III. METHODOLOGY

1) Study of research papers.
2) Design of shaft, rod and elbo.
3) SolidWorks simulation feature is used to find out stress
4) Fabrication of shaft, rod and elbo.
5) Mounting of shaft on wood board/iron board.
6) Assemble the all part.
7) Evaluating design moment and force and calculation.
8) Compare the actual result with model 9) And suitable application.

From the study of the mechanism, it was observed that any two pins must not lie on the same diameter. If this happens then the two links motion overlap each other because of this motion is interrupted. To keep the angle between any two pins not equal to 1800; number of links must be odd and equally spaced along p.c.d.

IV. CALCULATIONS & POST PROCESSING

A. DESIGN STRESSES OF ROD DIMETER OF ROD IS 12.6MM AND LENGTH IS 600MM

Z=0.78R3 Z=0.78×6.33 = 199.71KG/MM²

BENDING STRESS OF ROD Σ=PL4Z =294.3×6004×199.7 =221.04N/MM²

B. DESIGN STRESS OF HUB A HUB INTERNAL DIMETER IS 32MM AND OUTER DIMETER IS 92MM,LENGTH IS 82MM

p=100×9.81=981

$\sigma b = pDi2D02 - Di2$ =980×322922−322 =135.01N/MM

C. DESIGN STRESSES OF SHAFT A SHAFT DIMETER IS 30MM AND LENGTH IS 230MM

M=2151.11N×230mm=494755.3Nmm BENDING STRESS FOR SHAFT σ=32$M\pi$×d3 =186.649N/MM²

TENSIONAL SHEAR STRESS OF SHAFT Mt=60×106$kw2\pi n$ KW=7.5,N=120

MT=596831.03NMM

T=16MTΠD³ =16×596831.03Π×303 =112.57N/MM²

V. DESIGN STRUCTURE

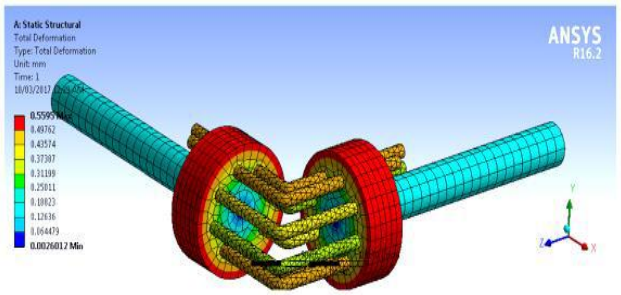

Fig 2. Software design

VI. CONCLUSION

During working on experimental setup and after a long discussion it is observed that proposed arrangement used for any set of diameters with any profile of shafts for skew shafts of any angle but the shaft's must be having the rotational motion about his own axis, transmission of motion is very smooth and desirable and used only for the equal R.P.M. of driving shaft and driven shaft by employing links or given type of links for appropriate joints for revolute pair. Some successful mechanical devices function smoothly however poor fly they are made while other does this only by virtue of a accurate construction & fitting of their moving parts. This projects which looks very simple & easy to construct was actually very difficult to conceive & imagine without seeing an actual one in practice. Motions demands to be studied first & we have done that very thing. We find that while acceptable analysis for existing mechanism can often be Made quite easily we cannot without insight & imagination make effective synthesis of new mechanism hence we are mould to present this our project gear less transmission at 90*(El-bow

mechanism) which we have managed to successfully device after long & hard input in conceiving its working principle.

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