Design and Analysis of Bent Pin Mechanism

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***Abstract*— In mechanical engineering, the power transmission system plays vital role while functioning of all the concerned machining elements. As per the position of shafts i.e. inline, parallel, non-intersecting or intersecting, there are various systems used for power transmission. Some of them are belt drives, rope drives, chain drives, gears, etc. The gears show some backlash error. The mounting and alignment of gears is also very critical. So it was conceived to develop a mechanism for power transmission in angular shafts without using the gear drives. This concept uses the sliding bent pins inside circular disks mounted on rotating shafts. The construction seemed to be very simple even for a layman**

I. INTRODUCTION

The power transmission between two shafts is a very important aspect of mechanical engineering design. Generally for intersecting shafts, the power transmission is achieved by using bevel gear.But the disadvantages of bevel gears are that they must be precisely mounted and the shafts' bearings must be capable of supporting significant forces.

Gear is very costly to manufacture and the Mechanical efficiencies of the gear drives is comparatively quite poor as compared to the link motion transmission drives. In case of gear drives the power is lost due to back lash in the teeth of the gears, Chattering of the gears and hunting of gear trains.

The Bent Pin Mechanism is also called as orbital mechanism since the rotating parts revolve around the axis similar to planets revolving around the sun. Sometimes the mechanism is also called as an angular drive or oblique drive mechanism. Whenever angular drives are required for machinery equipments the Bent Pin Mechanism comes in handy.

The Bent Pin drive was later perfected by the Phillips company of Denmark for use in sterling engine for obtaining phase angle of the expansion and compression pistons for the necessary timing sequence. Now-a-days the mechanism is manufactured in polypropylene high density plastics and used in various angular drives, because of space restriction. Link motion drives are simpler to manufacture, simple to operate and less costly than the gear drives.

II. DESIGN CONCEPT

An unusual form of transmission of shaft located at an angle is shown by diagram motion is transmitted from driving to driven shaft through the rods which are bent to conform to the angle between the shafts. These rods are located in holes equally spaced around a circle and they are free to slide in and out shaft revolve. This type of a drive is suitable for where quite operation at high speed is essential but it is only recommended for light duty.

The operation of this transmission will be apparent by the action of one rod during a revolution. If we assume that driving shaft ‘A’ is revolving clockwise ,then driven shaft ‘B’ will rotate counter clockwise. As shaft ‘A’ turns the half revolution, rod ’C’ shown in the inner on most effective driving position slides out of both shafts ‘A’ and ‘B’ during the first half revolution and rod ’C’ then will be at the top. Then during the remaining half, this rod ‘C’ slides inwards until it again reaches to innermost position as shown in fig.1. In the meanwhile, the outer rod have of course passed through the same cycle of movement all rods are successively sliding inwards and outwards.

Although this transmission is old one, many mechanics are skeptical about its operation, however it is not only practicable, but has provided satisfactory for various applications, when the drive is for shafts which are permanently located at a given angle. Although this illustration shows 135 degree angle transmission, this drive can be applied to shaft located at intermediate angle between 0° and 180°.

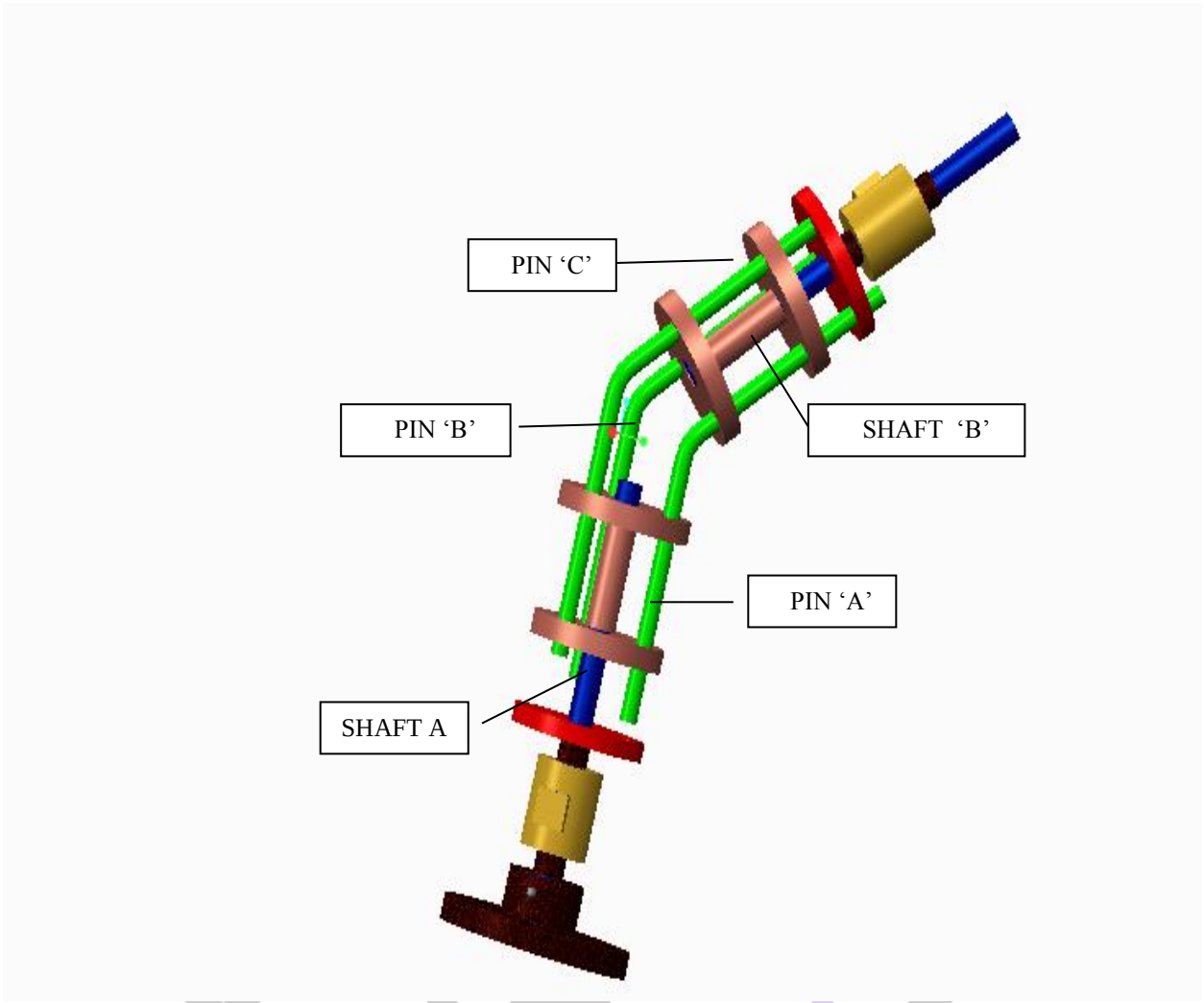

Fig- II..1 CAD model of bent pin mechanism

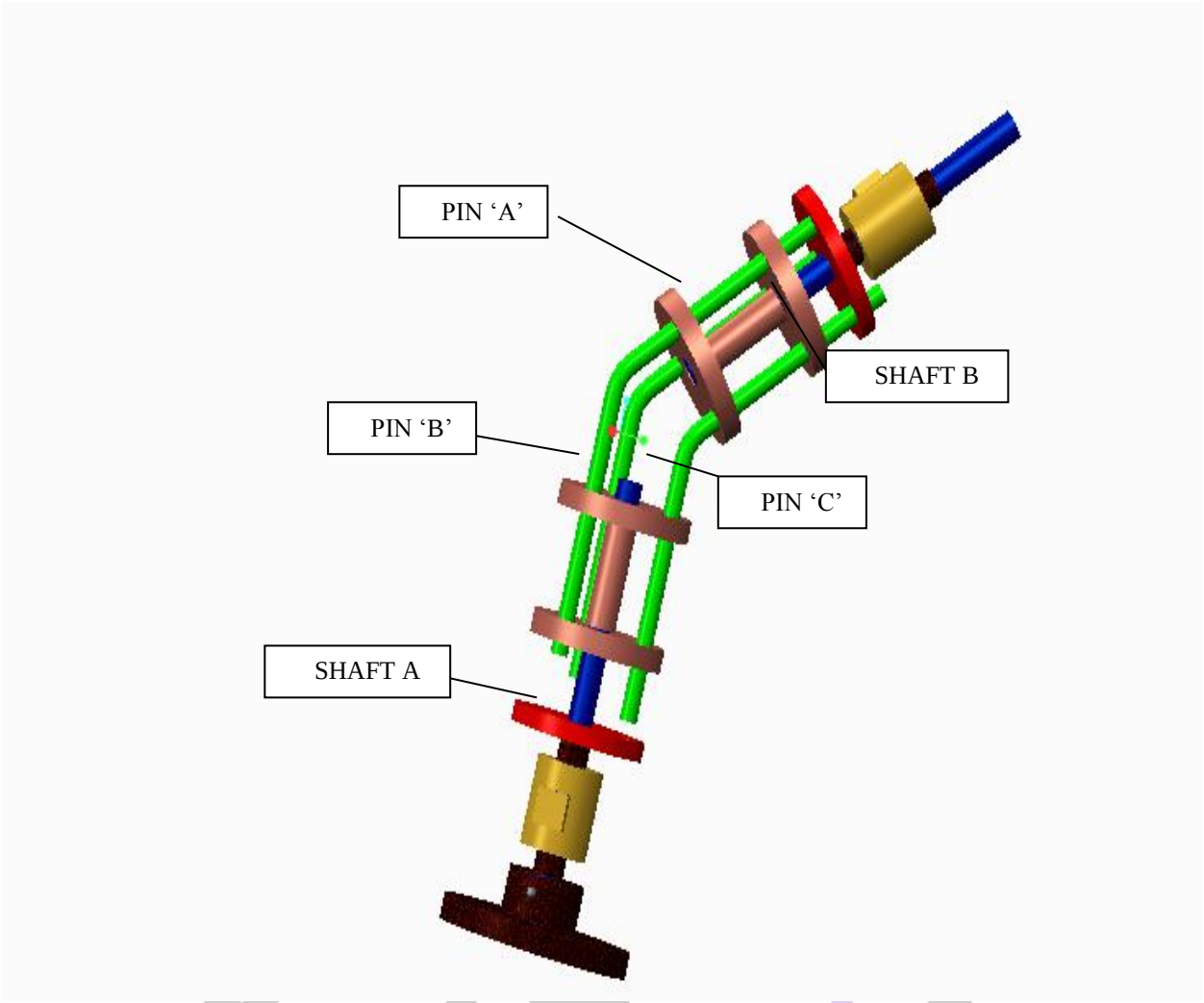

Fig- II.2. CAD model of bent pin mechanism (with rotated pins)

III. ANALYSIS OF MODEL

Results for Von Misses Stress

The minimum stress is found to be 0 MPa and maximum stress is 0.43734MPa at the contact between pulley and shaft.

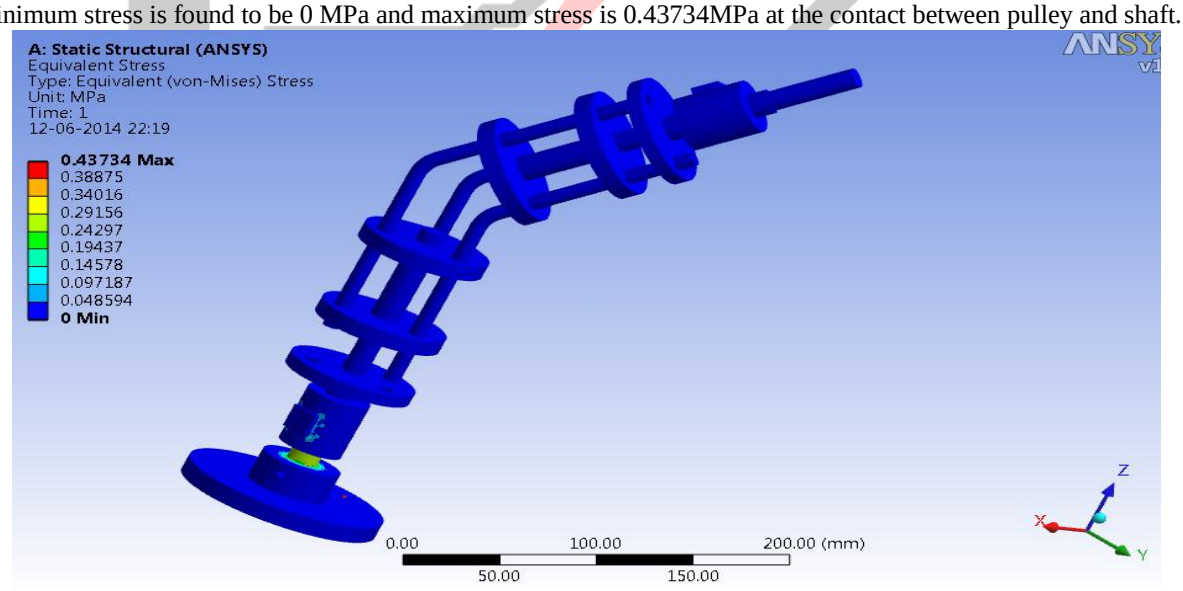

Fig IV.16 Results for Von Misses Stress

Results for Deformation Pattern

The Maximum deformation is found to be 0.00020658 mm at the pulley which is not very significant to be bothered about.

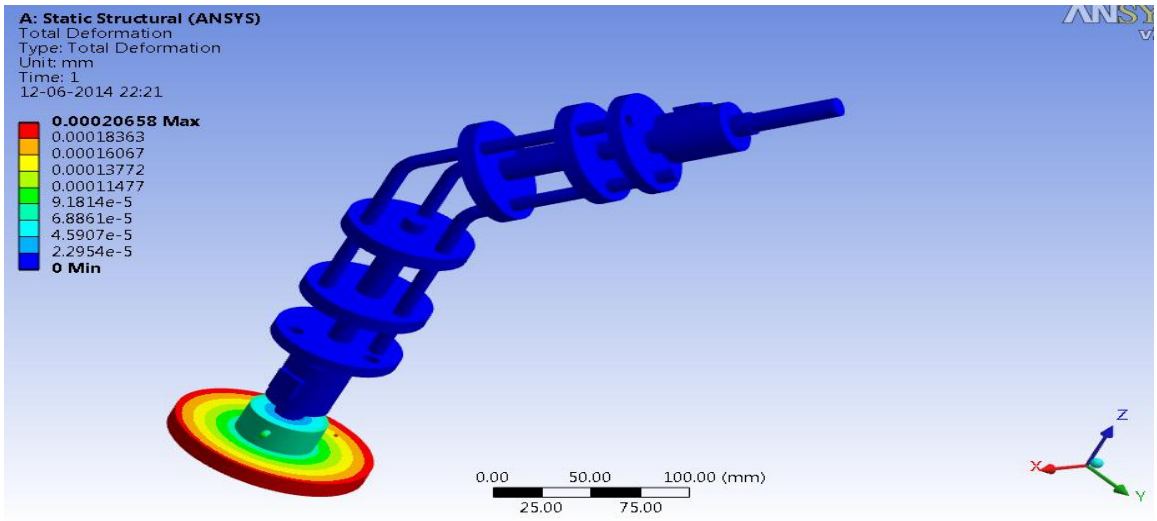

Fig IV.17 Results for Deformation Pattern

IV. RESULTS

The discussions are categorized on the basis of the results generated from the software. From the static structural analysis of bent pin mechanism, the results and discussion are shown below,

1. Results from design and modelling

1. The modelling gives the justified reason to develop such a mechanism which is very easy to develop as compared to the gear mechanism.
2. The fabrication and design of bent pin is quiet an easy job than that of gears which helps to avoid manufacturing errors.
3. This mechanism can be useful only in light duty conditions only due to its structural constraints.
4. The important aspect of variable speed ratio cannot be achieved by this mechanism.

2. Results from static structural analysis

1. Von misses stress developed is around 0.1458 to 0.1944 MPa near sleeve which is almost negligible.
2. The deformation pattern shows that the maximum deformation developed is at pulley which is close to 0.0001 mm which is once again not a great value to get bothered about.

V. CONCLUSIONS

Based on study of previous transmission mechanisms, it can be concluded that we have been successful in developing a mechanism which avoids the use traditional gear drives for angular transmission of power transmission. This mechanism is greatly contributing to avoid the frictional loss of power due to meshing in gears. This mechanism is greatly useful in light duty operations for precise and silent operations. While designing and developing the model, we also came to the conclusion that this comparative to gears, the Bent Pin Mechanism is easy to design as well as fabricate which justifies the economy . The complexity in gears have been successfully removed in this mechanism in every aspect.

VI. ACKNOWLEDGMENT

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