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Design and Analysis of Gearless Power Transmission by Rods Using Software Simulation

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ABSTRACT: Most of the machines transmit power from the input to the output with the help of gears. But, the efficiency of power transmission by spur gears is less due to friction losses. From the design point of view, there is a 10% energy loss per engagement for spur gears. Also, the construction of gears is complex and, thus, costlier. The gearless elbow transmission is a very economic and efficient mechanism and has shown an efficiency of up to 92%. This paper aims at analysing the gearless mechanism of transmitting power by Adjustable Elbow mechanism using software simulations. Most of the elbow mechanisms have a fixed position at a particular angle (60 or 90 degrees). However, we present a novel way to introduce adjustability in the system. The arrangement can work over a wide range of angles.

KEYWORDS: Elbow Rods, Power Transmission, Gearless Mechanism, Efficiency, Simulation.

I. INTRODUCTION

The modern engineering aims to achieve maximum possible efficiency by reducing wastage of power as much as possible. In most automobiles and industrial machines, the power is transmitted with the help of gears. However, the power transmission by gears involves a lot of frictional losses [1] [2]. Also, gear mechanism involves a fixed position between the input and the output drives. Bevel gears have been used extensively to transmit power only at certain fixed angles. The proposed mechanism aims at reducing the frictional losses and increasing the degrees of freedom of power transmission. A gearless transmission system using elbow rods can be as much as 90% efficient. The mechanism which we have proposed in this paper shows the ability of an elbow mechanism to transmit power at any angle. We have simulated the design of a 3-pair elbow rods transmission mechanism using software simulations.

II. RELATED WORK

Mahantesh Tanodi et al. used the Oldham's coupling to transmit the power from a motor to a shaft instead of gears [2]. One of the first machines that utilised elbow slide-pair transmission mechanism was developed by Atish Lahu Patil [3]. The Elbow-rods transmission system transmits power by rolling and sliding, which have shown to decrease the frictional losses considerably. The design of the link mechanism to achieve a perfect rolling and sliding pair in an elbow-rod transmission was devised by Mukesh Kumar and Amit Kumar [4]. Multiple views of gearless transmission systems with three elbow rods were designed by R. Somraj et. al [5]. Design software is a useful tool in designing components and mechanisms along with simulating the working conditions viz stresses, strains and displacements of machine design. Navneet Bardiya et al., using analysis software, calculated and simulated the stresses acting on the elbow mechanism and the reaction forces acting on the points of the joints [6]. Jagushte G. S et al. [7] estimated the

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design stress of the shaft and housing of the transmission setup for the proper and smooth working of the shaft by selecting the desired factor of safety.

III. SYSTEM SETUP

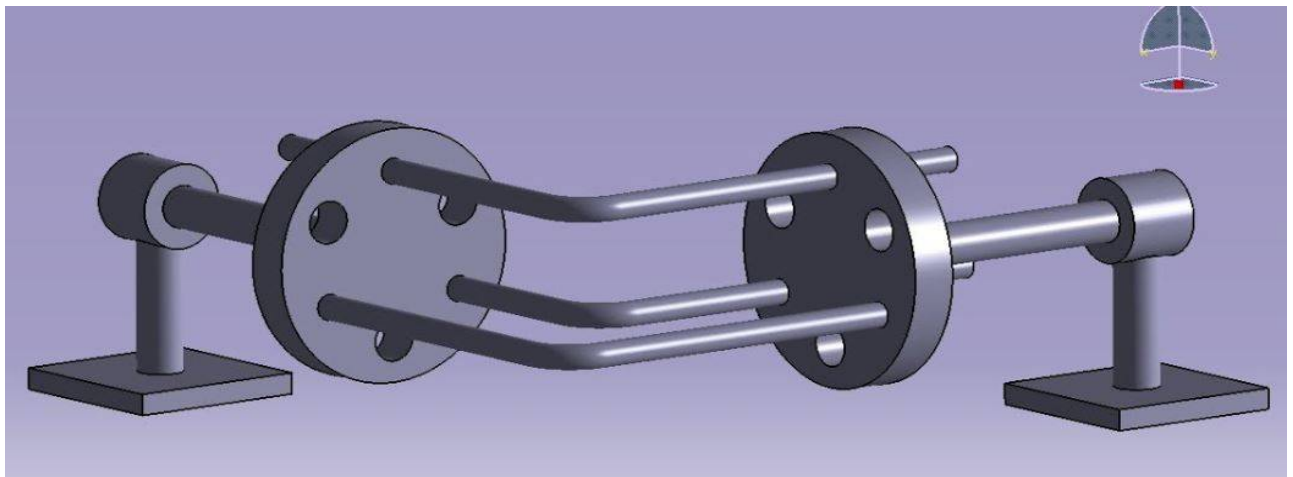


Fig.1. Basic Setup of Elbow-Rods Transmission System in SolidWorks.

The installation consists of two cylindrical housings and elbow rods radially inserted in the housings as shown in fig. 1. Fig. 1 shows an elbow transmission at 120 degrees. The number of elbow rods can be anywhere between three, for rough transmission, to eight, for the smooth transmission. This gearless transmission system can transmit power at any given angle between the input and output shafts.

IV. WORKING

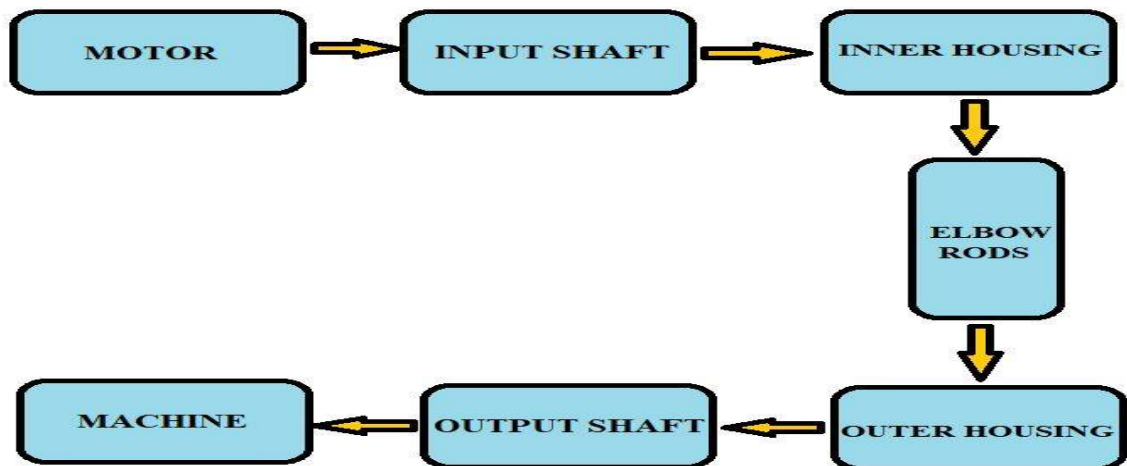


Fig. 2. Flowchart Representation of Gearless Elbow Transmission System

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Figure 2 shows the working of a gearless elbow transmission system. The motor provides the power to the input shaft connected to the cylindrical input housing. The elbow rods connect the input and the output housings. The output housing connected to the output shaft drives the machine. When the input shaft rotates, the input housing rotates along with it. The elbow rods or links rotate with the housing and slide in the channels in such a way that the power transmits to the output housing. This way, an efficient transmission with minimal frictional losses is achieved.

V. SOFTWARE ANALYSIS

The material selected for housing and shaft is Mild Steel 45C8, and for elbow rods, the material chosen is Stainless steel AISI 430 (1.4016, X6Cr17) [8].

Figure 3 shows stress distribution over elbow rods at 90 degrees based on the following data:

RPM	60	90	110	130	150
DIRECT STRESS N/mm ²	4.23	4.28	4.36	4.46	4.58

Table 1. Direct Stresses in the Elbow rods at different RPMs.

Table 1 analyses the stresses of rods at various rpm ranging from 60-150 rpms. The stress increases as the speed increases.

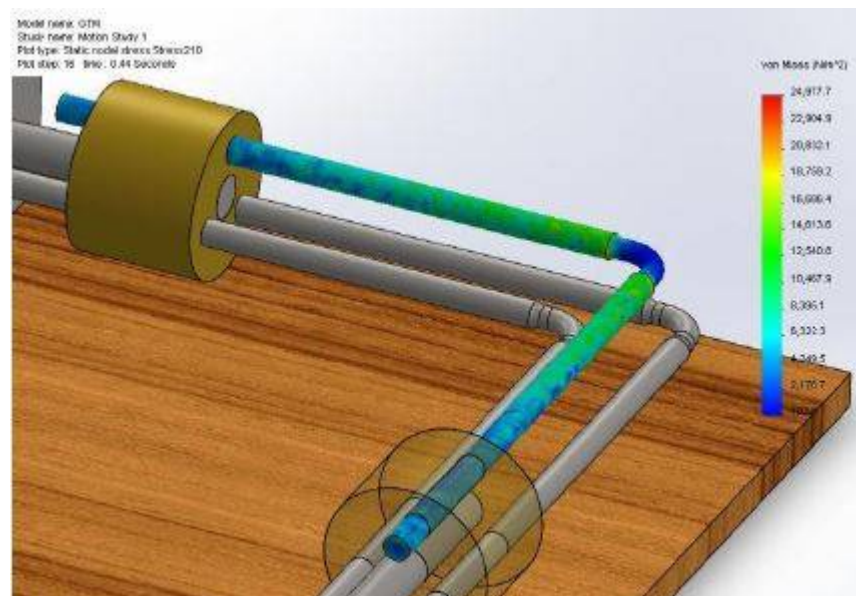


Fig.3. Stress Distribution Over Elbow Rods.

The steel used in rods is AISI 430 (1.4016, X6Cr17). The software analysis shows that the fabrication and design of the system are safe when used at speeds up to 150 rpm.

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VI. PROPOSAL

The elbow rods form the sliding and rolling pairs which help in transmitting the power from one shaft to the other. The two cylindrical housings can be fastened at any desired angle to each other. We have proposed an additional setup for the system which can help transmit power at any desired angle. This kind of transmission is possible because the driven housing can be adjusted to any angle between -90 to 90 degrees as shown in the fig. 4. The stress distribution over the nut-bolt coupling angled at 120 degrees is similar to one-piece elbow rods inclined at 120 degrees. The strength of the nut bolt coupling is maximum at zero degrees (when the two shafts are parallel) and decreases with increasing angle.

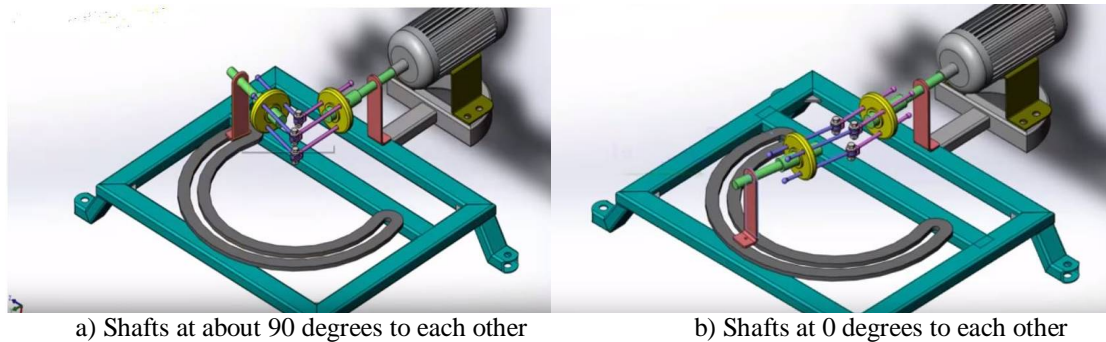


Fig. 4. Arrangement of Adjustable Gearless Transmission at various angles

VII. CONCLUSION

The proposed adjustable rod gearless transmission mechanism is an effective mechanism for transmitting powers for short lengths over a wide range of angles between two shafts. The design can effectively reduce the costs and increase the efficiency of power transmission. Advancements in the material and setup can further increase the efficiency.

REFERENCES

- [1] Petry-Johnson, T. T., Kahraman, A., Anderson, N. E., Chase, D. R., "An Experimental Investigation of Spur Gear Efficiency", Journal of Mechanical Design, Vol.130, Issue 6, 2008.
- [2] Velex, P., Cahouet, V., "Experimental and Numerical Investigations on the Influence of Tooth Friction in Spur and Helical Gear Dynamics", Journal of Mechanical Design, Vol. 122, Issue 4, 2000.
- [3] Tanodi M., Yapalaparvi, S. B., Mattikalli, A. C., Inamdar, D. N., Chiniwalar, G. V., "Gearless Power Transmission-Offset Parallel Shaft Coupling", International Journal of Engineering Research & Technology, Vol. 3 Issue 3, March 2014.
- [4] Patil, A. L., Jadhav, V. P., Patil, S. P., Shelar, R. S., "Gearless Mechanism in Right Angle", International Journal on Recent and Innovation Trends in Computing and Communication, Vol. 4, Issue 4, pp.145 – 149.
- [5] Kumar, A., Kumar, M., "Gearless Power Transmission for Skew Shafts (A SRRS Mechanism)", International Journal of Advanced Science and Technology Vol.79 (2015), pp.61-72, 2015.
- [6] Somraj, R., Sailesh, B., "Design and Fabrication of Gearless Power Transmission for Skew Shafts", International Research Journal of Engineering and Technology (IRJET), Vol. 4 Issue 04, Apr -2017.
- [7] Bardiya, N., Karthik, T., Rao, L. B., "Analysis and Simulation of Gearless Transmission Mechanism", International Journal of Core Engineering & Management (IJCEM) Volume 1, Issue 6, September 2014
- [8] Jagushte G. S., Hrishikesh, K., Vikas, P., Vishal, V., "Design, Analysis and Fabrication of Gearless Transmission by Elbow Mechanism", International Journal for Scientific Research & Development, Vol. 4, Issue 02, pp. 688-689, 2016.
- [9] Kiran S., Yadav, S. P. S., Sandeep, G. M., Naik, R., "Design, Analysis and Fabrication of Gearless Power Transmission by using Elbow Mechanism", International Journal of Engineering Research & Technology (IJERT), Vol. 6 Issue 04, April-2017.
- [10] Yasarkhan, Raihan, S., Pankil, P., Hiren, P., and Patel, D., "A Review Paper on Design and Analysis of Gearless Transmission Mechanism Using Elbow Mechanism", International Journal of Advanced Mechanical Engineering, Vol. 7, Issue 1, pp. 31-40, 2017.
- [11] Peckner, D., Bernstein, I. M., "Handbook of Stainless Steels", McGraw-Hill, 1977.
- [12] Parr, J. G., "Introduction to Stainless Steels", ASM International, 1999.