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# Design and Manufacture of a Hybrid Gearbox Reducer System

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**Abstract :** Due to mechanical energy losses and a competitive of minimizing these losses and increases the machine efficiency, the need for contactless gearing system has raised. In this work, one stage of mechanical planetary gear transmission system integrated with one stage of magnetic planetary gear system is designed as a two-stage hybrid gearbox system. The permanent magnets internal energy in the form of the magnetic field is used to create meshing between contactless magnetic rotors in order to provide self-system protection against overloading and decrease the mechanical loss of the transmission system by eliminating the friction losses. Classical methods, such as analytical, tabular method and the theory of elasticity are used to calculate the planetary gear design parameters. The finite element method (ANSYS Maxwell) is used to predict the behaviors of a magnetic gearing system. The concentric magnetic gearing system has been modeled and analyzed by using 2D finite element method (ANSYS Maxwell). In addition to that, design and manufacturing processes of prototype components (a planetary gear, concentric magnetic gear, shafts and the bearings selection) of a gearbox system are investigated. The output force, the output moment, the output power and efficiency of the hybrid gearbox system are experimentally evaluated. The viability of applying a magnetic force to transmit mechanical power through a non-contact gearing system is presented. The experimental test results show that the system is capable to operate continuously within the range of speed from 400 rpm to 3000 rpm with the reduction ratio of 2:1 and maximum efficiency of 91%.

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