Design and Development of Test Rig for Gear Testing and Inspection

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Abstract:

Gears have been utilized for centuries and will continue to play a vital role in the future. In some cases, gears are produced in large volumes, such as those used in specific machine gearboxes. The performance of a gear is influenced by several factors including material, design, manufacturing process, operational conditions, and the surrounding environment. Among these, manufacturing is particularly critical as it directly impacts gear accuracy. To ensure precision, inspection at various stages of production is essential. However, this inspection process should be cost-effective in terms of both labor and time. Therefore, it must be straightforward to perform and operate. Gear inspection is primarily classified into two main categories. The proposed gear test rig will allow all gears to be mounted on a stationary or adjustable plate, depending on the measurement requirements. While testing a particular gear, the remaining gears will serve as master gears, enabling the detection of composite errors. This setup is compact, making it suitable for shop floor use, and can be operated efficiently without significant downtime. Furthermore, the rig can be adapted to measure various gear parameters as needed. Implementing such a system will enhance productivity by reducing inspection time and labor requirements the test rig has been designed and developed to measure composite errors in gears used within the helical gearbox of a ginning and pressing machine at JGPL. Its construction enables the individual inspection of each gear while also allowing for the observation of the overall meshing conditions, closely replicating the behavior of gears within an actual gearbox assembly. The animated simulation of the test rig, created using design software, demonstrates its effectiveness and practicality for shop floor application. By enabling gear inspection directly in the machine shop, the need for inspection in the assembly shop—where gears are traditionally tested after being mounted in the gearbox—is eliminated. This significantly reduces time spent in the assembly process.

Moreover, early detection of gear variations at the machine shop stage prevents the need to return faulty gears from the assembly line, thereby avoiding production delays and minimizing losses in labor and operational time.

Keywords:

Coordinate Measuring Machine CMMs, Parkinson's Gear Tester, Gear blank, Involute gear.