ABSTRAK

3D *zoetrope* merupakan perangkat visual yang menghasilkan ilusi gerak melalui susunan objek tiga dimensi yang diputar secara berurutan. Kestabilan struktur mekanisme menjadi faktor penting agar putaran objek 3D *zoetrope* berlangsung baik. Penelitian ini bertujuan merancang dan membangun struktur mekanisme 3D *zoetrope* menggunakan sistem transmisi *timing belt* GT2 dengan rasio 1:3 dengan sistem yang kokoh dan stabil. Metode yang digunakan adalah metode rancang bangun pendekatan deskriptif teknis, meliputi identifikasi kebutuhan, perancangan komponen, pemilihan material, pembuatan, perakitan, perhitungan elemen mesin, dan pengujian kinerja struktur mekanisme. Komponen utama meliputi box kayu sebagai struktur utama, motor DC 12V, *timing belt* GT2, puli bergigi, poros berdiameter 8mm, dua *pillow block* tipe KLF08, *flange* berbahan POM White, rel pengatur posisi motor berbasis ulir, serta cover akrilik. Sistem transmisi menggunakan puli 20 gigi pada motor dan puli 60 gigi pada poros sehingga diperoleh rasio 1:3. Hasil perhitungan menunjukkan daya rencana 0,0432 kW, momen puntir 779,2 kg.mm, tegangan geser poros 7,76 kg/mm², gaya berat piringan 9,32 N, dan beban setiap pillow block 4,66 N. Pengujian menunjukkan struktur mekanisme bekerja stabil pada 50, 100, dan 150 RPM, sedangkan pada 250 RPM getaran struktur tergolong kecil. Pada 150 RPM, poros mampu menopang piringan 3D zoetrope bermassa 0,95 kg tanpa kendutan yang terlihat secara visual. Rel pengatur motor mampu mengatur ketegangan timing belt sehingga transmisi tetap stabil. Berdasarkan hasil tersebut, struktur mekanisme 3D *zoetrope* menggunakan *timing belt* GT2 rasio 1:3 telah memenuhi tujuan perancangan dan dapat digunakan sebagai media pembelajaran serta demonstrasi mekanisme transmisi daya.

Kata kunci: 3D *zoetope*, struktur mekanisme, *timing belt* GT2, rasio 1:3, poros.

ABSTRACT

A 3D zoetrope is a visual device that produces the illusion of motion through a sequence of three-dimensional objects arranged and rotated in succession. The stability of the mechanical structure is an important factor in ensuring that the 3D zoetrope objects rotate properly. This study aims to design and develop a 3D zoetrope mechanical structure using a GT2 timing belt transmission system with a 1:3 ratio to produce a rigid and stable system. The method used is an engineering design method with a descriptive technical approach, consisting of needs identification, component design, material selection, manufacturing, assembly, machine element calculations, and mechanical structure performance testing. The main components include a wooden box as the main structure, a 12 V DC motor, GT2 timing belt, timing pulleys, an 8 mm diameter stainless steel 304 shaft, two KLF08 pillow blocks, a POM White flange, a screw-based motor position adjustment rail, and an acrylic cover. The transmission system uses a 20-tooth pulley on the motor and a 60-tooth pulley on the shaft, resulting in a 1:3 ratio. The calculation results show a design power of 0.0432 kW, a torsional moment of 779.2 kg.mm, a shaft shear stress of 7.76 kg/mm², a disc weight force of 9.32 N, and a load of 4.66 N on each pillow block. Testing showed that the mechanical structure operated stably at 50, 100, and 150 RPM, while the structural vibration at 250 RPM was relatively small. At 150 RPM, the shaft was able to support the 0.95 kg 3D zoetrope disc without visibly significant deflection. The motor adjustment rail was also able to regulate the timing belt tension, maintaining stable transmission. Based on these results, the 3D zoetrope mechanical structure using a GT2 timing belt with a 1:3 ratio fulfilled the design objectives and can be used as a learning medium and demonstration tool for power transmission mechanisms.

Keywords: *3D zoetrope, mechanical structure, GT2 timing belt, 1:3 ratio, shaft.*