Design & Development of a Static-Thrust Test-Bench for Aviation/UAV Based Piston Engines

Authors : Syed Muhammad Basit Ali, Usama Saleem, Irtiza Ali

Abstract : Internal combustion engines have been pioneers in the aviation industry, use of piston engines for aircraft propulsion, from propeller-driven bi-planes to turbo-prop, commercial, and cargo airliners. To provide an adequate amount of thrust piston engine rotates the propeller at a specific rpm, allowing enough mass airflow. Thrust is the only forward-acting force of an aircraft that helps heavier than air bodies to fly, depending on the mathematical model and variables included in that with the correct measurement. Test-benches have been a bench-mark in the aerospace industry to analyse the results before a flight, having paramount significance in reliability and safety engineering, depending on the mathematical model and variables included in that with the correct measurement. Calculation of thrust from a piston engine also depends on environmental changes, the diameter of the propeller, and the density of air. The project would be centered on piston engines used in the aviation industry for light aircraft and UAVs. A static thrust test bench involves various units, each performing a designed purpose to monitor and display. Static thrust tests are performed on the ground, and safety concerns hold paramount importance. The execution of this study involves research, design, manufacturing, and results based on reverse engineering initiating from virtual design, analytical analysis, and simulations. The final evaluation of results gathered from various methods such as co-relation between conventional mass-spring and digital loadcell. On average, we received 17.5kg of thrust (25+ engine run-ups – around 40 hours of engine run), only 10% deviation from analytically calculated thrust –providing 90% accuracy.