Abstract

The thesis describes the development of linear permanent magnet synchronous actuator for short stroke linear motor, delivering significant force even at low velocities.

The development of permanent magnet (PM) materials and the availability of the modern power electronics, PM machine topologies have evolved .Therefore, design work on PM machines has becoming increasingly important. PM machines are becoming popular, because they have high power density and usually more efficient. Linear permanent magnet actuator finds applications in robotics and machine tools and positioning devices.

The report gives the design and development of tubular linear permanent magnet synchronous actuator. Neodymium Iron Boron (NdFeB) magnets are used for the size compactness. The study of various permanent magnets including their properties and applications in the design of electrical machines are covered in the report. In the tubular topology, the outer casing consists of stator frame with the concerned armature winding, and the mover consists of the ring shaped magnets separated by stainless steel.

The 3-phase input to the machine is fed through a rectangular current controller with PWM inverter. In the design approach the air gap flux density and pole pitch are taken for calculating the magnet thickness using the equivalent magnetic circuit calculations. The analysis has been carried out using rectangular and sinusoidal current controls. MAGNET software has been used to simulate the Tubular PM ,motor and results obtained by the analytical calculations done using MATLAB was compared and found to be in good correlation. The dynamic performance of the machine is also simulated. The analytical calculations have been done using MATLAB. The design is carried out for 3 phase, 150N, and 225W tubular linear permanent magnet synchronopus actuator and the results have been covered in the report.