

MODELING THE BEHAVIOR OF A HOMOPOLAR MOTOR

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ABSTRACT

The design, construction, and operating characteristics of a homopolar motor are described in this thesis using both physical experimentation and simulation software. This type of motor converts electrical energy into mechanical energy using the Lorentz force. The torque from this force is used to propel the homopolar motor forward. The nickel-metal hydride batteries used in this study store 2500 mJ of energy. This energy is discharged by creating a short circuit between the anode and cathode of the battery using the armature, a piece of non-magnetic conductive wire. When this current moves through a magnetic field which is not parallel to the wire, a Lorentz force is induced, causing the wire to exert a force on the ground which is strong enough to propel the apparatus forward. By using various armatures and lubricants, top average speeds of 0.71 m/s were achieved. An electromechanical model of the homopolar motor is developed in PSpice. This simulation is used to predict the performance of the homopolar motor, including position and speed. Motor measured performance results and those predicted by computer simulation are compared and presented.