Abstract

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A novel reversible dc series motor drive

Series DC motor has a high starting torque and therefore it is used in traction applications. Reversing speed direction of this machine is conventionally achieved via a relay arrangement which results in waste of energy during braking. Regenerative operation reduces the time taken to stop the machine and feeds energy back to the supply, hence improves the overall performance and efficiency. In this paper, a novel reversible DC series motor drive is presented which allows both speed control within the constant torque region and reversing speed direction through regenerative operation while providing the conventional performance of the DC series motor. The field winding is connected to the armature via an uncontrolled bridge rectifier to keep direction of field current unchanged. The armature and rectifier field combination is connected to a DC supply via a class E-chopper. The operation of the proposed reversible drive is explained and the dynamic model is presented. The switching of the chopper is controlled so as to provide positive and negative voltage loops across the series, armature-rectified field windings. The transient response of the open loop control system is theoretically simulated using MATLAB software and experimentally investigated using the PIC16F877 microcontroller.