

Abstract

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Vector control drive of permanent magnet motor without a shaft encoder

Permanent Magnet Synchronous Motors (PMSMs) are receiving increased attention for drive applications because of their high torque to inertia ratio, superior power density, and high efficiency. To control PMSM, position and speed sensors are indispensable because the current should be controlled depending on the rotor position. However, these sensors are undesirable from standpoints of size, cost, maintenance, and reliability. There are different ways of approaching this problem, depending on the flux distribution. This paper presents a novel vector control for a permanent motor drive without use of a shaft sensor. The vector control drive provides a wide range of speeds, high torque capability and high efficiency. Two line-to-line voltages and two stator currents are sensed to produce the stator flux linkage space vector. The angle of this vector is then used to produce the appropriate stator current command signals which can be controlled to maintain zero d-axis current which is the condition of vector control, over a wide range of torque and speed. A speed signal is derived from the rate of change of angle of the flux linkage. Simulation is carried out in order to evaluate the behavior of the proposed method for different operating situations. The simulation results demonstrate that a good steady-state and transient performances for the proposed sensorless scheme are obtained.