

Abstract

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Unity power factor control of permanent magnet motor

The Permanent Magnet Synchronous motors (PMSMs) have gained an increasing interest recently. The wide variety of applications of PMSM drives makes it necessary to achieve fast and reliable drive control system design. Vector control of PMSM can achieve fast dynamic response with less complexity and parameter-independent controller, prevent demagnetization of the motor and allow maximum efficiency operation. In this paper, a novel Unity Power Factor (UPF) control drive for PMSMs is presented. The drive is performed with constraint on the (PF) such that its steady-state value is unity. This feature provides an extension of the constant torque region, resulting in higher output power of the PMSM drive, which is desirable in many applications requiring extended speed range at rated motor torque. However, this drive is not optimal in terms of efficiency which will be less than that obtained from conventional decoupled vector control drive for the same torque. Therefore, it is concluded that before reaching the rated speed, the conventional decoupled vector control is preferable, whereas, the UPF control is optimal to have a wider range of speed operation (above the base speed of the conventional vector control) and hence, extension of the constant torque region. Above this extended base speed, the PMSM drive can be operated in constant power mode using the conventional field-weakening technique having constant supply voltage and current. The drive system is built using MATLAB-SIMULINK software. The validity is evaluated in both steady-state condition and transient response using computer simulation.