This paper describes a position estimation approach based on high-frequency voltage injections for dual three-phase permanent magnet synchronous machines (DTP-PMSM) whose sets of windings are spatially shifted by 360 electrical degrees. Fail-operational drives gain more and more importance in automotive applications. Typically, multiphase machines are used to realize fail-operational properties. Besides the machine, also the sensing of the phase currents and the rotor position has to be fault-tolerant. It is therefore obvious to reduce the overall system cost by using sensorless control methods as a monitoring and fallback solution in fail-operational drives. In this paper, the sensorless capability of the symmetrical dual three-phase machine at zero and low speed is investigated. It is shown that, compared to an ordinary three-phase machine, this type of machine enables a significant reduction of both the torque and battery current ripples produced by high-frequency voltage injections. Moreover, it is shown that, under certain conditions,
the proposed injection method reduces the acoustic noise produced by voltage injections. The proposed injection method is furthermore implemented in a "slowly-sampled" control system, in which the sample rate of the controller is chosen several times lower than the PWM frequency. For this purpose, a suitable position estimation approach is developed. Experimental results show the effectiveness of this method.