Determination of Magnetic Field Changes in Single-Phase Shaded Pole Induction Motors due to Slotting of the Rotor

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Abstract

For steady-state simulation of the single-phase shaded pole induction motors most often circuit-field or 2D field models are applied with stationary (immovable) discretization grid. Considering the movement of the rotor with respect to the stator it is necessary to use models with movable grid. These models allow for discrete simulation of the rotor movement and at the same time pulsation of the magnetic field in air-gap due to slotting of the rotor. The models with movable grids usually require longer computation time on account of reconstruction of the mesh and renumbering of nodes for each position of the rotor. Application of fixed mesh in whole of cross-section of the motor makes that problem become simplified but it permits considerable reduction of computation time. Of course, changes of frequency of induced currents in the rotor due to its slip should be taken into account while modelling of the motor with stationary discretization grid. The paper presents the circuit-field method and simulation results of flux density computation in the air-gap at steady-state operation of the motor for several positions of the rotor with respect to the stator. The effective currents of stator windings and rotors bars obtained from a harmonic circuit model were treated as input forces in the static field model of the motor. The obtained results of simulation show that average value of the normal magnetic flux density on surface of the rotor subject to variation in the range of (0.5-1)% from starting to rated speed operation of the motor.