

Impedance calculation for die-cast rotors

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1 Abstract

When using induction machines with die-cast rotors and closed rotor slots the value of the rotor impedance is frequency dependent and it depends also strongly on the operating current. With the help of a FEM multi slot-model the rotor parameters could be pre-calculated precisely.

The FEM-analysis is carried out in two steps. In the first step the model is solved in a non-linear static analysis with focus on the magnetic vector potential A_z accounting for stator currents. Rotor currents are impressed by defining a constant current density J_i for each bar.

In the second step a linear time-harmonic analysis with all quantities varying at slip-frequency is accomplished, with only the rotor-currents present. As this will be a skin-effect analysis, a coupled analysis with two degrees of freedom (magnetic vector potential and time-integrated voltage) is utilized.

As result we get the actual current distribution in the rotor-bars as well as the distribution of the magnetic field. With the source-current density J_s the bar - impedance Z can be calculated.

The method has been applied for several induction rotor geometries and results have been verified with parameters presented in literature.