8.3.3 Electrical model

From an electrical point of view, an AC motor is a load which can be represented, in a fairly simplified and non-exhaustive model, as the network in diagram below (the real equivalent model is more complex).

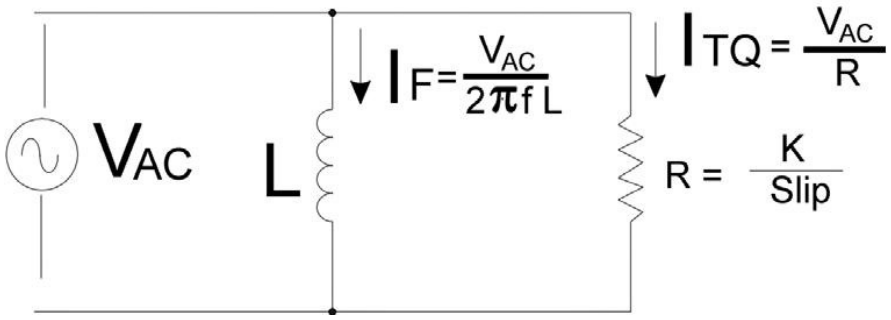

Figure 8: *Simplified AC motor electrical model.*

The strength of the rotating magnetic field is proportional to I_F, the current flowing through the magnetizing inductance L.

I_F is a mathematical aid which is used to describe the magnetic energy which is stored in the motor and is therefore known as *magnetizing current*. The value of L depends on the design of the motor.

Current flows through L is proportional to the voltage applied and inversely proportional to the frequency.

The torque produced by the motor is proportional to the slip. Increasing the slip decreases R, the rotor's equivalent resistance seen by the stator.

Current I_{TQ} is dependent on both the value of resistance R and the voltage input. Power consumed/regenerated by the rotor is mostly active power.

I_F and I_{TQ} can both be set by controlling the frequency and the magnitude of V_{AC}, the voltage applied to the motor's stator winding.

It is desirable to maintain I_F at a constant value which produces maximum field strength in the motor's magnetic circuit, while varying I_{TQ} to satisfy the changing torque requirement. Maintaining constant I_F requires the ratio of V_{AC}/f be held constant.

As motor speed increases, the frequency f increases proportionally: until a point is reached (typically the nominal speed) where V_{AC} cannot be increased further (for example, because it has reached the maximum allowable voltage supplied by the batteries). and V_{AC}/f can no longer be held constant.

Then, above the nominal speed, the controller is forced to limit the flux and, as a result, the output torque is lessened too.

However, the controller is able to partially counteract this torque reduction by increasing the slip, thus allowing the motor to be efficiently even at speeds higher than the rated one.

SME s.p.a. Via della Tecnica 40 Z.I.
36071 ARZIGNANO (VI) ITALY
Phone +39 0444 470511 - Fax +39 0444 451803
info@grupposme.com - www.grupposme.com