

8.4 ITC vector drive system

As stated above, in the last few decades the improvements in Electronics have made possible to use complex control system also for AC induction motors, in order to precisely set the output torque by employing Intelligent Torque Controls (ITC).

The most efficient algorithm is the flux vector control, which is based on a flux and torque control, depending on motor parameters knowledge and speed and current measurements. It is more complex than different control algorithms (like scalar control or slip control), but it gives much more performance, zero speed control, fast and precise dynamical response and more efficiency.

8.4.1 Basic operation of ITC vector drive system

The motor control algorithm used by SME is known as Field Orientated Control.

A schematic block diagram of a flux vector control is reported in Figure 9.

The vector flux control used by SME motor drive systems involves the following blocks:

- **Speed reference block.** The reference speed is set by pedal accelerator, which is limited and interlocked with other various signals such as: Seat, Hand brake, Pedal brake, Start, Forward, Reverse, Steering position. The resulting speed N_r is compared with the motor actual speed N_m calculated from the motor speed sensor signal. A regulator sets a required torque T_r to correct the speed error.
- **Speed sensor.** A quadrature pulse encoder is installed in the AC motor as speed sensor measuring the speed and the direction of the rotation.
- **Flux position.** The flux position is estimated and sent to the PWM modulator and current decoupling blocks.
- **Current decoupling.** The phase currents are measured and decoupled using suitable transformations and sent to the flux and torque estimators.
- **Torque control.** The required torque T_r is compared with the estimated torque T_e and the error is sent to a PI regulator.
- **Flux control.** The required flux F_r is compared with the estimated flux F_e .
- **Inverter voltage.** Combining the U_{sx} and U_{sy} voltage with flux frequency, a Space Vector PWM modulator is used to generate the logic state of the signals which drive the MOSFET's in the power module.