
6.2 Methods of Sensing Inductance

The fundamental types of inductance sensors are based on the following principles.

- *Phase pulsing*: a voltage pulse V is applied to an unenergized SRM phase by the drive converter for a period of time ΔT and the change in coil current ΔI is measured. The inductance is obtained from $L = V \frac{\Delta T}{\Delta I}$.
- *Frequency modulation*: inductance information is encoded in a frequency-modulated signal using a low voltage analog circuit.
- *Phase modulation*: a low alternating voltage is applied to an unenergized phase of the SRM and the phase angle difference between the input voltage and the resulting current is detected. The inductance is given by $L = \frac{R \tan \phi}{\omega}$ where ϕ is the phase angle.
- *Amplitude modulation*: a low level alternating voltage is applied to an unenergized phase and the amplitude of the resulting current is mapped to the coil inductance. The inductance can be expressed as $L = \frac{1}{\omega} \sqrt{\frac{V_m^2}{I_m^2} - R^2}$ where V_m is the voltage amplitude of the input alternating voltage, I_m is the current amplitude and R is the resistance in the circuit.
- *Self voltage technique*: the inductance of the active phase is estimated in real time from measurements of the active phase current and phase flux. If I_0 is the current in the active phase linking a flux Ψ_0 then the phase inductance is given by $L_0 = \frac{\Psi_0}{I_0}$.

6.3 SRM Sensorless Operation Based on Flux/Current Characteristics

The rotor position can be calculated from the magnetic characteristics provided that ψ (or L) and I can be measured. Some flux/current based sensorless methods are given below.

- *The Waveform detection technique* relies on monitoring the phase current rise and fall times due to change in the incremental phase inductance which varies as a function of current and rotor position.
- *The State Observer* method based on terminal measurements of voltage and currents used as inputs of a digitized electromagnetic model of the SR machine.

7. An Example Studied

An example is given below of the implementation and realization of a Switched Reluctance motor controlled in speed and connected to an alternating supply voltage. Few results are given.