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SENSORLESS CONTROL OF PERMANENT-MAGNET SYNCHRONOUS MOTORS FOR IMPROVED PERFORMANCE

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Energy efficiency, low acoustic and electromagnetic noise emission are becoming prime demands for commercial AC drives. The solution for this is to employ more and more controlled motor drives rather than using DC or induction motors that operate open loop. Even though the industries in North America and Europe have been developing their products to meet those demands, the tendency of using efficient variable speed AC drives in domestic and industrial environment is not at a satisfactory level in developing countries like Sri Lanka.

Availability of efficient and fast switched voltage supplies *(inverters)* and powerful digital signal processing devices *(micro-controllers, Digital Signal Processors (DSP), etc.)* has enabled the design engineers to produce variable speed AC drives with feedback control loops for either speed or angular position. The invention of Permanent Magnet Synchronous Machines *(PMSM)* has now emerged as a challenging alternative to the conventional Induction Machine *(IM)*.

In recent years there has been significant development and attention for the control of PMSMs of various types. There are definite advantages of PMSMs over IMs due to their high efficiency, high torque to current ratio, high power density and low inertia. Conventional PMSM drives employ a shaft mounted encoder or a resolver to identify the rotor flux position. This maintains the synchronism that is an essential requirement in drive control. But on the other hand, in most applications the presence of an encoder or resolver causes several disadvantages due to additional cabling cost, a higher number of connections between motor and controller, noise interference and reduced robustness. This arises the need to develop sensorless *(i.e. measurement is replaced by estimation)* control schemes for PMSM drive systems.

We can basically identify two categories of position *(and speed)* estimation methods proposed so far. One is the extraction of position information available in the back emf. The other method is the injection of a high-frequency sinusoidal voltage or some other disturbance in order to detect the saliency of the rotor. The aim of this paper is to introduce a new position *(and speed)* estimation method using the back emf technique. It also presents some results obtained in dealing with periodic disturbances occurred during real-time implementation of the above method.

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