Chapter-17

Velocity Control of A PMSM Fed By an Inverter -Dc/Dc Buck Power Electronics Converter

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Describing the background with a disclosure of the project stakeholder company followed by main goals, questions that will be investigated and the scope of the project. gives an account of and motivation for the methodology used for the project. introduces the two types of permanent magnet motors, how they are constructed and what differentiates them. This knowledge will be the basis for a recommended motor design for the project. describes the prototype that has been developed for the project. It also accounts for design considerations for each part of the prototype, such as necessary torque output calculation and how to measure current. In mathematical model of the motor is derived. Assumptions that are made in the process of developing this model will be accounted for. The systems equations in this chapter form the basis for simulations further on. Parameters in the motor model are either experimentally identified or validated. The method of generating sinusoidal phase currents with space vector modulation is described in presents field-oriented control which is one of two control laws that are evaluated in the project. Simulation the closed loop system performance is presented.

When several approaches are available for solving a specific type of problem, a critical evaluation will be made in order to defend the chosen method. By doing so the reader will become aware of the rationale behind every decision made. Control parameters and motor measurements that are presented in this report is naturally related to the type of motor and load. The validity of these results for another motor of the same type is directly related to motor production variation and prototype sensor accuracy and precision. Regarding generalization of the solution to other PMMs, the authors are confident that the described method will produce similar performance. Although proof for this is left for future work.

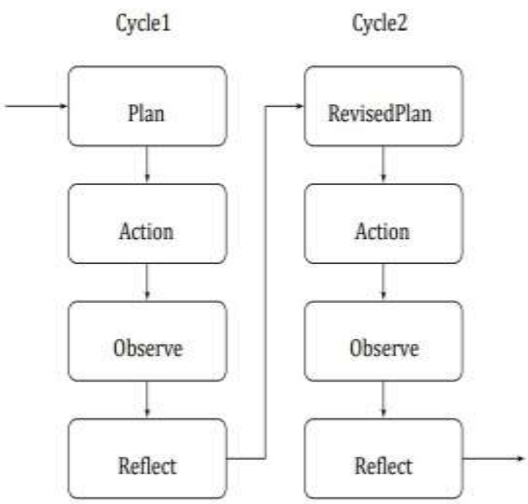

Fig 1: Block Diagram

The windings of the stator are activated, a rotative magnetic field will develop within the stator. If we think of this field as a rotational pair of poles the unloaded rotor will be aligned to the field of the stator and will spin in synchrony with the field. The forces between poles depicted are radial and do not generate any torque. If the rotor has been loaded with a braking force, it will slow down slightly in relation to the field of rotation. In the end, the rotor's axis won't longer align with the stator's axis, and the forces that are generated between the poles will create mechanical torque, which is opposed to the brake torque. Any changes in load will not result in a change in the speed of the rotor (as happens with an Asynchronous motor). The rotor, both in idle

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(no loading) and when it is loaded, will rotate at a rate equal to that of the magnetic field rotating (synchronous velocity). But, if the torque of the load exceeds what is the electromagnetic maximum torque for the motor (if the angle between the rotor and stator the axes exceed 90 degrees) then the machine will lose synchronization and stop for a period of period.

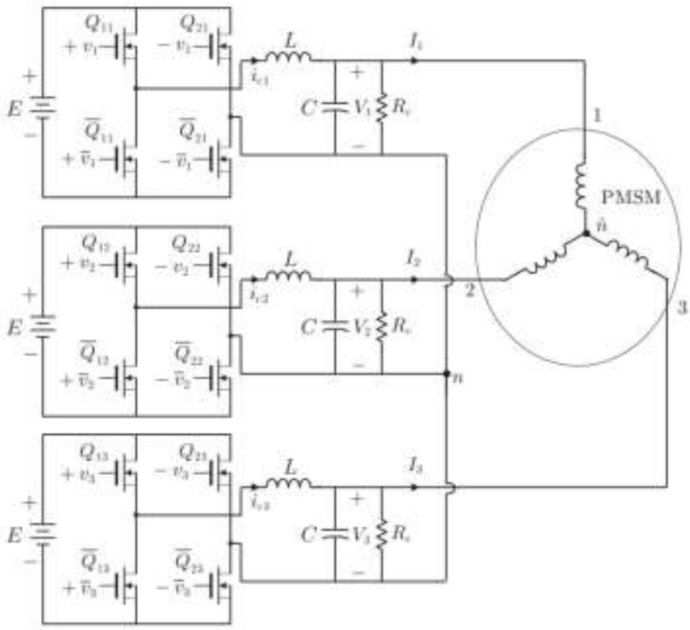

Fig 2: The inverter- DC/DC Buck power electronic converter PMSM system

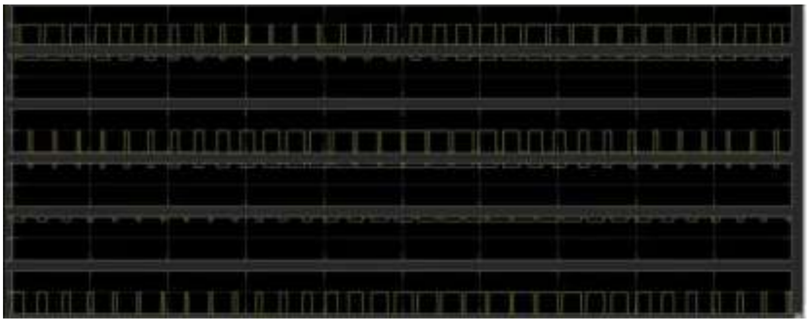

Fig 3: Output Waveforms

We have presented, for the first time, a velocity controller for a permanent magnet synchronous motor when it is fed by and inverter-Buck DC/DC power converter system. Although our stability proof only ensures local asymptotic stability, the merit of our proposal is that this is the first time that such a problem is solved for an AC motor. Moreover, our controller is much simpler when compared to proposals in the literature for DC motors which are designed using differential flatness or backstepping.

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