Design and implementation of a drive for porotype Synchronous Reluctance Motor

In recent years, the reluctance synchronous motor has received much attention due to its simple and robust structure. From a control standpoint, one of the major advantages of this machine is that it can be used as a suitable replacement for induction motors in many applications, such as pumps and fans.

FOC is one of the vector control methods widely used in electric drives. Since the electric drive system is inherently a nonlinear system with parameters mismatch, the use of robust nonlinear controllers will be necessary. The figure below shows an overview of the control of an electric motor.



In this thesis, a super-twisting sliding mode control is designed and implemented for a reluctance synchronous motor. The simulation results show that the controller performs very well in repelling disturbances as well as following the reference values. Also, in order to increase the efficiency of the motor, the strategy of maximum torque per amp has been used. Due to the lack of access to the reluctance synchronous motor, an IPMSM motor has been used to implement the proposed method. It should be noted that these two motors are very similar to each other and are slightly different in the MTPA discussion. Therefore, the simulation results of MTPA method for both types of motors are presented and confirm the achievement of maximum torque on the current. The proposed control method is implemented on the IPMSM motor and the system based on the TMS320F28335 processor manufactured by Texas Instruments. The results are stored on DSP buffers with high accuracy and finally plotted. The strategy of maximum torque per amp has also been applied to this motor and its results have been presented. For example, the following figure shows the result of simulating the engine speed by applying a load torque step of 0.5 seconds in the two proposed methods and the method presented in the reference [39] in the dissertation. The stability of the method presented in this figure is clearly known.

