Task 1

Using the provided Simulink template to finish the PM synchronous machine model.

Check:

First try to give a zero load torque.

For 5 Hz stator frequency command, the rotor speed should be 5*60 = 300 rpm (It is electrical rpm). When supplying 20 (V) peak **phase** voltage, the corresponding phase current peak value is around 13.3 (A).

Task 2

The machine is controlled by stator frequency of 5 Hz and phase voltage of 20 (v) (peak value). Please draw the phasor diagram in the final steady state operation conditions for :

Case 1. Load torque = 0 Nm.

Case 2. Load torque = 10 Nm.

Task 3

Supplying the machine with constant shaft speed of 2*pi*50 (rad/s) (electrical speed), and supplying the machine with Vd = 0 (v), Vq = 2*pi*50*Lndmpm. Now, when running the model, the phase current should be zero. Please use the machine terminal phase voltage generated to calculate the peak value of the rotor PM flux linkage (named as “Lndmpm”).

Task 4

Supplying the machine with proper voltages, in order to test the Ld, Lq inductance. (Locked rotor test.)

Task 5

Design an I/f controller for this PM machine.

Reference frequency command: ramp up from zero to 2 Hz in one second, and then keep the frequency to be 2 Hz.

The current amplitude is set to be 5 (A). The load torque can be set to be 10 Nm.

Please draw the phasor diagram for this situation when running at the final steady state.

Now change the current amplitude to 10 (A), and please draw the corresponding phasor diagram when running at the final steady state.