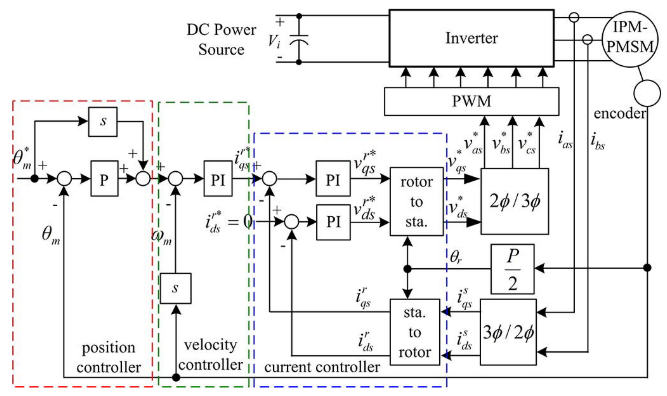
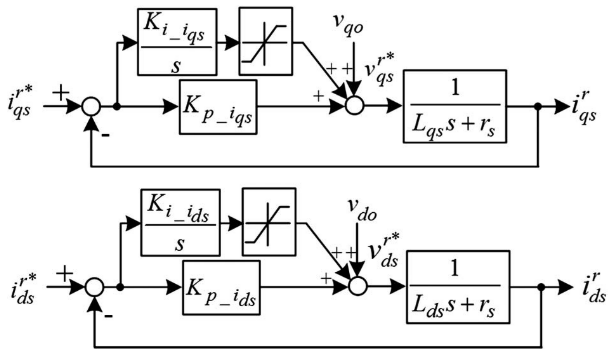
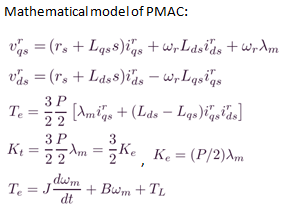
**AUTO-TUNING ALGORITHMS – FOR SUMMER WORKS IN ARCELIK**

This report contains practical and easy to use auto tuning algorithms for servo drive systems.

**1. Yang S.M., Lin K.W., Automatic Control Loop Tuning for PMAC Servo Motor Drives**

Used motor control – drive system:

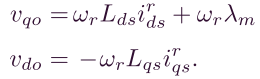
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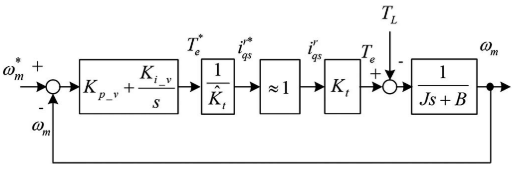
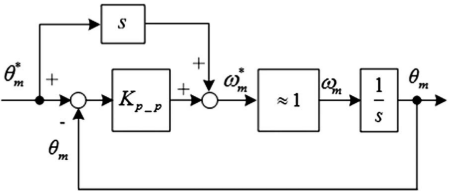
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Where,

|  |  |  |
| --- | --- | --- |
| **Variables:** | **Electrical Parameters:** | **Mechanical Parameters:** |
| : rotor pole number | : Series resistance | : Electromechanical torque |
| : rotor electrical speed | : d-axis inductance | : Disturbance load torque |
| : rotor mechanical speed | : q-axis inductance | : Torque constant |
| : Laplace operator | : Back EMF constant | : Rotor and load inertia |
| : Back EMF+Cross coupling | : Rotor PM flux linkage | : Viscous friction coeff. |

The *cross-coupling voltages* ( )and the back EMF voltages are decoupled using the estimated electrical parameters and rotor speed.



Simplified velocity control loop: Simplified position control loop:** **

**Algorithm:**

|  |  |
| --- | --- |
| **1.**  Controller gains After the the auto tune process | **A) Current PI Controller gains set**  The gains of the current controllers are designed for the ratio between the proportional and integral gains to cancel out the pole.  🡪 After this cancellation, q-axis closed loop transfer function :  🡪 : cutoff freq., it can be  set 10 of velocity loop.  The gains can be set as:  🡪 The d-axis gains can be similarly determined.  **B) Velocity PI Controller gains set**  🡪 After this assumption, velocity closed loop transfer function :  🡪 : cutoff freq., it can be  Higher than position loop.  The gains can be set as:  🡪 must known for initial set  **C) Position P Controller gain set**  🡪Similarly, assuming that the bandwidth of the velocity control loop is  much higher than that of the position control loop.  **Remark:** |
| **2.**  Electrical Parameter Estimation | **A) Series resistance**  To avoid error caused by rotor movements, resistance is measured by applying a *d-axis voltage pulses* as shown:  🡪  **B) Inductances ()**  The inductances are measured by applying voltage pulses to the q-and d-axes, and the peak currents are then measured for calculating the inductances.  🡪h<100us, d axis excitation time x2  Measure the peaks  Excite  of q axis excitation. Because of  Preventing the rotor movement.  Resistance drop neglected.  The d-q axes voltages are simplified as:  Inductances are approximately:  🡪 |
|  |  |
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|  |  |