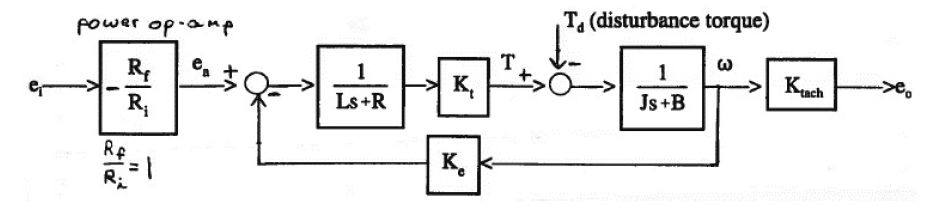
Part 3 a)

The MUT in the open-loop set-up is still connected to the back-drive motor, therefore it would experience both motor’s moment of inertia as well as damping conditions. Assuming both motors are the same, the system equation of the MUT relating the output angular velocity to the input voltage is:

The transfer function is then:

b) From the block diagram, when the disturbance torque is equal to the motor torque , the output velocity would be zero, and would equal to the stall torque of the motor at the input voltage.

For input voltage, , at stall torque:

Where from experimental data, from spec sheet, from information given, for step input, and assuming and converted to the right units. Since :

The negative sign indicates an arbitrary direction.

c) The inductance of the motor is three magnitudes smaller than the resistance, will be simplified to for this section:

The gain , and the time constant , where , the values are found to be: