From the armature motor, the equation of voltages for the circuit is:

The equation that relates the motor torque and the rack is:

The angular position that the rack rotates can be defined as a linear position as:

The mass-spring system is defined by the following equation:

Now, rewriting all equations in Laplace form, we obtain:

From equation (2):

Replacing this term in equation (1):

Replacing this term in equation (3):

Now, replacing the expression for into the equation (4):

Then:

Replacing the parameters numeric values:

1. Find K

From the transfer function shown above, it can be seen that: