

Modelling and Simulation (TNG022 2024HT PO)

Lab1 Preparation.

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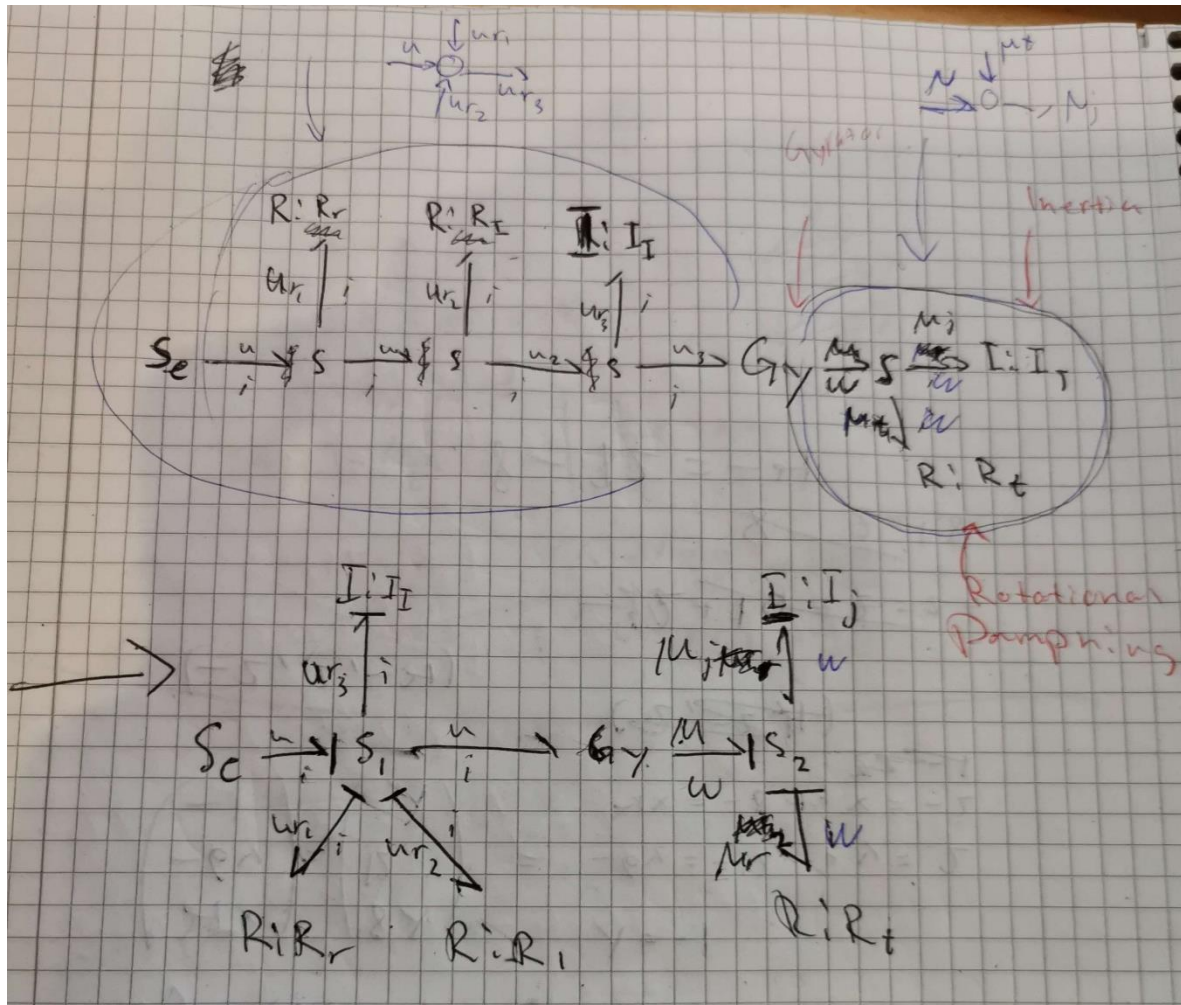
Version: (1)

Preparation 1.1 Prepare the model of the motor in block scheme. Use the Simulink

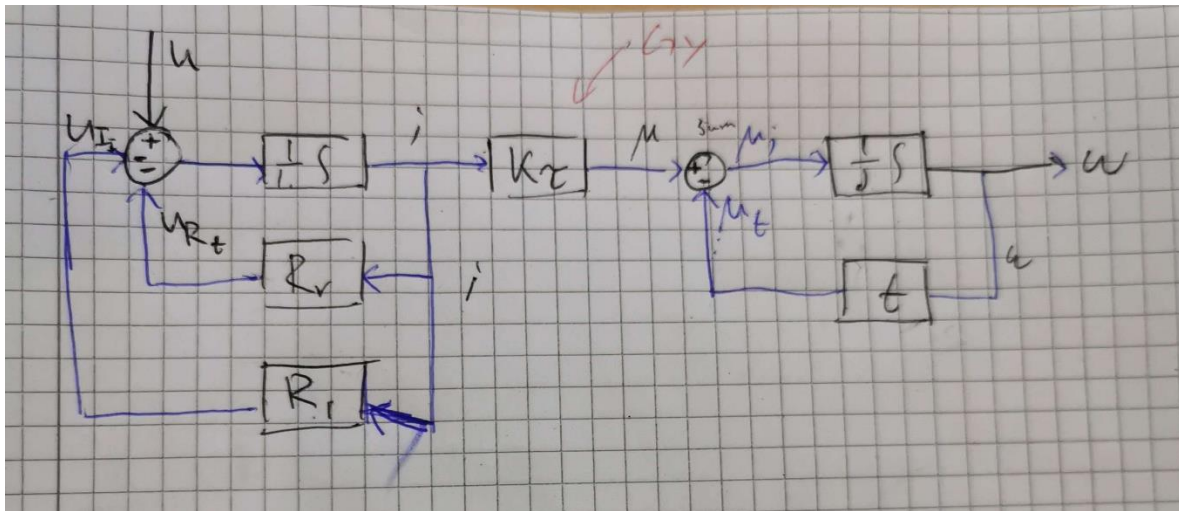
blocks: Integrator, Gain, Sum.

Start by drawing the bond graph for the system and derive the block diagram from the bond graph

Graph:

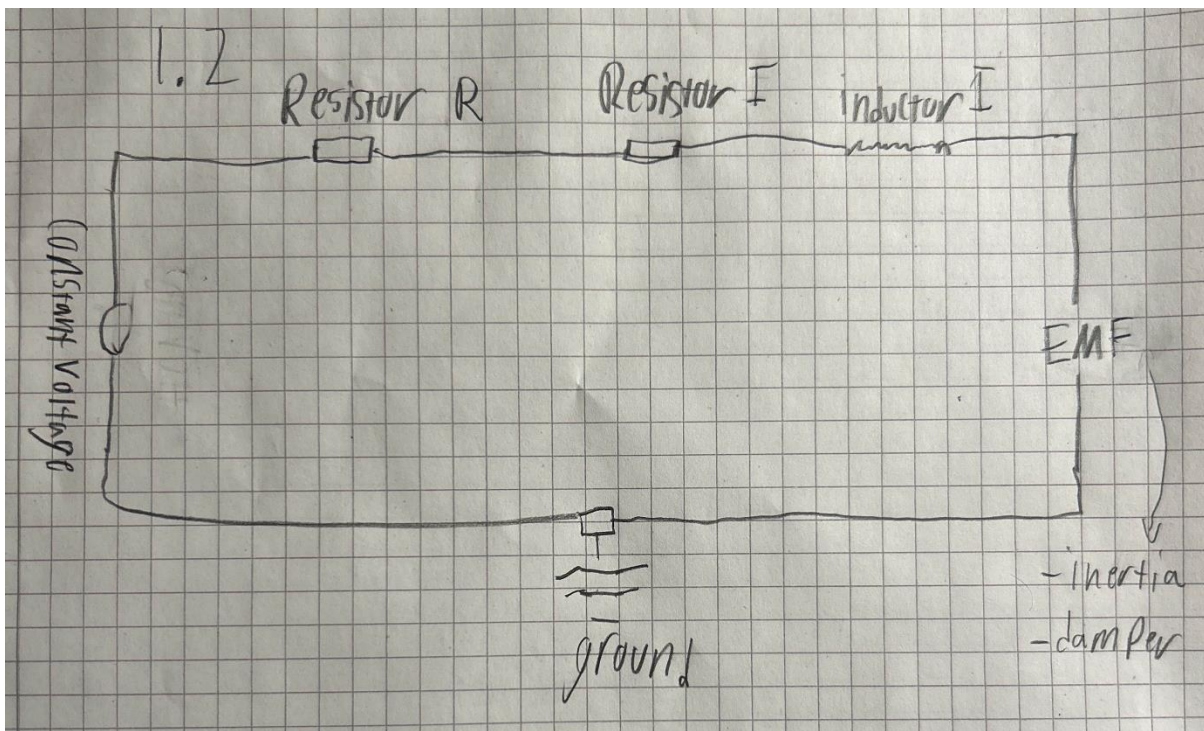


This gives this block diagram below:



Preparation 1.2 Think through how an object-oriented model should look like in OpenModelica and which standard blocks you need. Draw a sketch of the OpenModelica

model. Use tips given in Appendix B



Preparation 1.3 Determine the numerical values for all the constants in your model.

The mechanical friction of the motor can be obtained from the diagram in Figure 8 in

Appendix A by the slope of the straight line.

Be careful with the units! Note that $60 \text{ RPM} = 1 \text{ Hz} = 2\pi \text{ rad/s}$.

1.3 Armature resistance $R_I = 0,8 \Omega$
Terminal resistance $R_r + R_I = 1,15 \Omega$ $R_r = 0,35 \Omega$
Armature inductance $L_I = 3,39 \text{ mH} = 3,39 \cdot 10^{-3} \text{ H}$
Torque constant $k_T = 0,056 \text{ Nm/A}$
$$J = \frac{\pi}{2} r^4 h \rho$$

$$r = \frac{20}{2} \text{ mm} = 10 \cdot 10^{-3} \text{ m} = 0,01 \text{ m}$$

$$h = 10 \text{ mm} = 0,01 \text{ m}$$

$$\rho = 2,7 \cdot 10^3 \text{ kg/m}^3$$

$$\text{for } J = \frac{\pi}{2} \cdot 0,01^4 \cdot 0,01 \cdot 2,7 \cdot 10^3 = 1,35 \cdot \pi \cdot 10^{-7} \text{ kgm}^2$$

$$b = \frac{\Delta m}{\Delta \omega} = \frac{0,13 - 0,2}{(6000)/(60 \cdot 2\pi)} = -\frac{0,07}{200\pi}$$