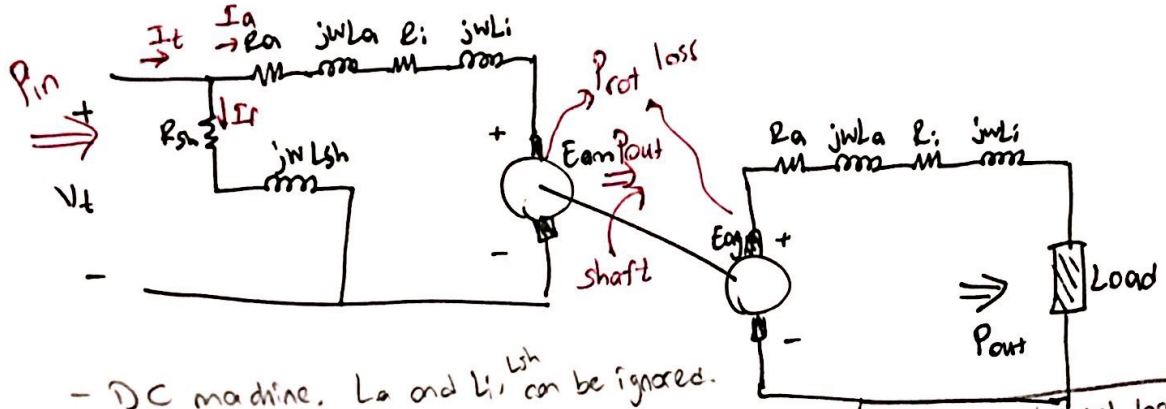
1 DC Motor shunt connected

1 DC Gen. Seperately excited (mech. coupled to motor.)

$R_a = 0.8\,\Omega$, $12.5\,mH = L_a$ — 220V, 23,14A, 1500 RPM

$R_{sh} = 210\,\Omega$, $L_{sh} = 23H$

$R_i = 0.27\,\Omega$, $L_i = 12mH$



- DC machine. L_a and L_i, L_{sh} can be ignored.
- Assume machine is working at rated conditions.
- Assume rotational losses are 200W.

$V_t = 220V$, $I_t = 23,14A$, $P_{in} = 5148\,W$

$P_{field\text{-}loss} = I_f^2 R_{sh} = 230W$

$I_f = \frac{V_t}{R_{sh}} = \frac{220}{210} = 1,0476\,A \Rightarrow I_a = I_t - I_f = 22,3524\,A$

$E_{am} = V_t - I_a(R_a + R_i) = 220 - 22,3524\,(0,8+0,27)$

$E_{am} = 196\,V$ ← Induced Voltage at the motor side. (at rated conditions)

$P_{out} = E_{am} I_a - P_{rot,loss} = 196 \times (22,3524) - 200 = 4181\,W$ (200 assumed)

$P_{in(generator)} = P_{out} - 200W_{(assumed)} = 4181 - 200 = 3981\,W$

- After this part, voltage induced over the generator affects the output power. It also affects the current passing through the circuit. Now, assume E_{ag} (voltage induced over generator) is 190 V.

$P_{in(generator)} = 3981 = E_{ag} \cdot I_{ag} = 190 \cdot I_{ag} \Rightarrow I_{ag} = 20,95\,A$

$P_{out} = (E_{ag} - (R_a + R_i) I_{ag}) \times I_{ag} = (190 - 1,07 \times 20,95) \times 20,95 = 3510,8\,W$

$\eta_g = \frac{P_{out}}{P_{in} + P_{field\text{-}loss}} = \frac{3510,8}{4181 + 230} \times 100 = 79\,\%$

→ $P_{field\text{-}loss}$ is added because generator is field excited and it didn't drawn in the schematic above.