Experiment 4  DC Motor

PRELIMINARY STUDIES

In this section you should read your lecture notes and answer following questions before coming to the laboratory. There will be a quiz concerning these questions.

Q1. Draw the equivalent circuit of separately excited DC machine, and show current and power paths for motor operation.

Q2. Write steady-state equations of separately excited DC motor.

Q3. Draw the equivalent circuit of shunt excited DC machine, and show current and power paths for motor operation.

Q4. Write steady-state equations of shunt excited DC motor.

SIMULATION

In this first part, experiment will be simulated using Matlab/Simulink. Using the given machine and simulation diagram in the figure below, adjust load torque values at the mechanical input and observe changes in ω, Ia, If, and Te.
EXPERIMENT

DC motor will be loaded by connecting resistive load to the terminals of the DC generator that is coupled to motor’s shaft. For separately excited and shunt excited motor configurations fill tables below and do required calculations. You can use the given equations below and you should show all of your calculations.

\[
P_{\text{mechanical}} = V_a \cdot I_a - R_a \cdot I_a^2 \quad [W]
\]

\[
\omega = 2 \cdot \pi \cdot \frac{n}{60} \quad [\text{rad/sec}]
\]

\[
T_{\text{em}} = \frac{P_{\text{mechanical}}}{\omega} \quad [\text{N.m}]
\]

<table>
<thead>
<tr>
<th>SEPARATELY EXCITED DC MOTOR</th>
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<tbody>
<tr>
<td>LOAD</td>
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<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>0 W</td>
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<tr>
<td>300 W</td>
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<td>900 W</td>
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<td>1200 W</td>
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<table>
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<th>SHUNT EXCITED DC MOTOR</th>
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<td>LOAD</td>
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Q5. Plot $T_e$-$\omega$ relation for separately excited DC motor. ($T_e$ horizontal and $\omega$ vertical)

Q6. Plot $T_e$-$\omega$ relation for shunt excited DC motor. ($T_e$ horizontal and $\omega$ vertical)

Q7. Comment on the differences of two characteristics (separately excited and shunt excited DC motor characteristics) you plotted on above graphs.