DC Brushed Motors
\[ \tau = K_t i \]
\[ V_{\text{emf}} = K_e \dot{\theta} \]
\[ K_t (\text{mNm/A}) = 9.55 K_e (\text{V/krpm}) \]
\[ V_{\text{supply}} = Ri + L \frac{di}{dt} + V_{\text{emf}} \]
Inductive Effects: Transient Behavior

\[ V_{\text{supply}} = Ri + L \frac{di}{dt} \]

\[ i = \frac{V_{\text{supply}}}{R} \left( 1 - e^{-tR/L} \right) \]
\[
\dot{\theta} = \frac{V_{\text{supply}}}{K_e} - \tau \frac{R}{K_e K_t}
\]

or

\[
\dot{\theta} = \dot{\theta}_{nl} - \tau R_m
\]
\[ \tau = K_t i \]
\[ P_m = \tau \dot{\theta} \]
\[ = \tau \dot{\theta}_{nl} - \tau^2 R_m \]
\[ \eta = \frac{P_m}{P_e} \]

\[ = \frac{\tau \dot{\theta}}{V_i} \]

\[ = \left(1 - \frac{\tau_{\text{friction}}}{\tau}\right) \left(1 - \frac{\tau}{\tau_{\text{stall}}} \right) \]
Recommended operating range

In observation of above listed thermal resistances (lines 19 and 20) the maximum permissible rotor temperature will be reached during continuous operation at 25°C ambient.

= Thermal limit.

Short term operation

The motor may be briefly overloaded (recurring).

Motor with high resistance winding

Motor with low resistance winding
Faulhaber encoded right-angle DC gearmotor

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>nominal operating voltage</td>
<td>6 V</td>
</tr>
<tr>
<td>gearhead</td>
<td>141:1</td>
</tr>
<tr>
<td>shaft diameter</td>
<td>3 mm</td>
</tr>
</tbody>
</table>