Operation Mode

Please do the following exercises individually.

Torque and efficiency

1. / Sketch a typical torque curve of a motor and describe the four most important characteristic values of the torque. Use the rotation speed as x-axis and the torque as y-axis. Draw the main torque values and the rotational speed values into the curve.

2. / A measurement shows that the magnetic flux density is 5T and the electrical current **I** is 1A. The number of windings n is 200 and the length of the conductor is 5cm.

- Calculate the torque of a drive shaft *M* with a radius *r* of 3 cm.

- Calculate the required input power P_{zu} for this machine at a rotation speed *n* of 1500 rpm if this has an efficiency η of 0.86.

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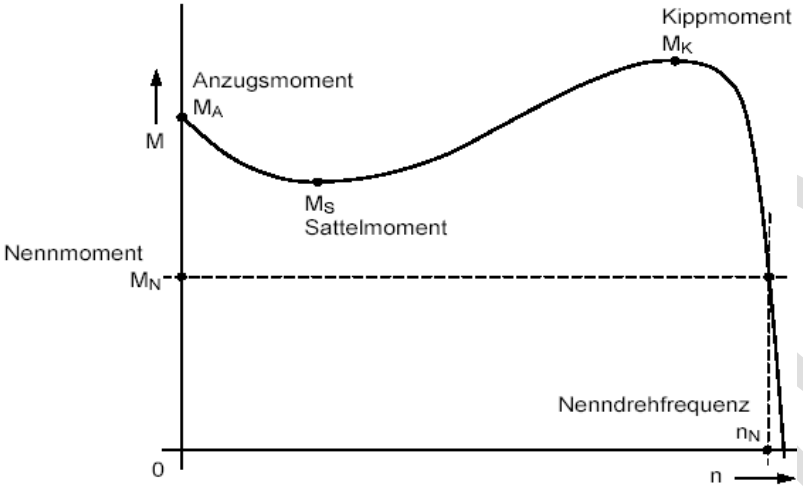
Diagram



Important torque values

M_A – tightening torque: n_N – nominal rotation speed

M_N – nominal torque: n_S – synchronous rotation speed:

M_K – tilting torque: n_K – tilting rotation speed:

M_S – saddle torque:

For full Solution look at book page 28

2. /A measurement shows that the *magnetic flux density B* is 5T and the *electrical current* I is 1A. The number of *windings z* is 200 and the *length of the conductor l* is 5cm.

Calculate the torque of a drive shaft with a radius of 3 cm.

Formulars

$F = B \cdot \mathrm{l} \cdot \mathrm{I} \cdot \mathrm{z}$

$M = F \cdot \mathrm{r}$

Calculation

$F = B \cdot \mathrm{l} \cdot \mathrm{I} \cdot z = 5\,T \cdot 0{,}05\,\mathrm{m} \cdot 1\,\mathrm{A} \cdot 200 = 50N$

$M = F \cdot \mathrm{r} = 50\mathrm{N} \cdot 0{,}03\mathrm{m} = 1{,}5\mathrm{Nm}$

- Calculate the required input power P_{zu} for this machine at a rotation speed *n* of 1500 rpm if this has an efficiency η of 0.86.

$$P_{ab} = \frac{M \cdot \mathrm{n}}{9{,}55} = \frac{1{,}5Nm \cdot 1500}{9{,}55} = 235{,}6W \qquad P_{zu} = \frac{P_{ab}}{\eta} = \frac{235{,}6}{0{,}86} = 273{,}96W$$