ELECTRICAL MACHINES

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TRANSFORMERS

Primary winding of single phase adjustable autotransformer is connected to $220V$ network. All power loses, saturation, magnetizing current and voltage drop can be neglected. Transformer is loaded with $1kW$ at $\cos\varphi = 0{,}95cap$. Tap changer is in such position that power which is transferred from primary to secondary via electromagnetic field is four times less than all transferred power from primary to secondary winding. Find the secondary current in this regime.

DC MACHINES

Shafts of two separately excited DC motors are coupled together and loaded with $50Nm$ torque. Fields of both motors are nominal. Friction, ventilation and iron losses, as well as voltage drop on brushes and induct reaction can be neglected. Rated data are as follows:

$M1:\ 220V\ ,\ 75A\ ,\ 1500rpm\ ,\ R_a = 0{,}2\Omega$

$M2:\ 220V\ ,\ 12A\ ,\ 1250rpm\ ,\ R_a = 0{,}8\Omega$

Both motors are connected to $200V$. Determine the shaft speed and torques of both motors.

INDUCTION MACHINES

Three phase induction motor has rated parameters: $1410rpm\ ,50Hz$, connection type Y. Stator resistance, friction and ventilation losses, as well as magnetizing inductance and iron losses can be neglected. Break-down torque is twice larger than nominal torque.

Motor is connected to rated voltage with frequency $75Hz$. Calculate how many times the current when slip is equal to break-down slip is larger than nominal current.

SYNCHRONOUS MACHINES

Three phase six poles synchronous motor has rated parameters: $380V\ ,\ 50Hz$, connection type Y, stator resistance and synchronous reactance are $R_s = 1\Omega\ ,\ X_s = 5\Omega$. Iron losses as well as fricition and ventilation losses can be neglected. Motor is connected to power network $380V\ ,\ 50Hz$. At some load the field current is choosen in such a way that stator current is equal to $14A$ and is on its minimal value. This field current is then kept constant.

Motor is additionally loaded and stator current rises to $45A$. Find the torque and power factor in this regime.

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