Instruction of simulation exercise

Starting methods of squirrel-cage induction motor

The aim of the exercise is to get familiar with the starting methods of squirrel-cage induction motor, allowing for limitation of the motor current. The simulation model includes:

- • a circuit Electrical Drive 1 - Star Delta – star-delta starting system,

- • a circuit Electrical Drive 2 - Soft start – soft-start system based on a thyristor AC converter,

- • a circuit Electrical Drive 3 - Inverter – a starting system using a frequency converter.

Starting systems are equipped with appropriate control systems, respectively *Control system 2* and 3. The control algorithm of the soft-start system (*Control System 2*) limits the motor current (parameter *Imax*, *CONST.1*). In the drive system with a frequency converter (*Control system 3*) the parameter influencing the starting current and the starting time is the rate of frequency change, set in the block *Freq ramp* (parameter *f_req*, *CONST.5*).

Plan of the exercise

1. For the star-delta method observe the waveforms of motor currents, fluxes, torque and speed (*Scopes – Star/delta*) for three values of load torque (eg. 10%, 20%, 40% - could be set in the block *load_profile*) . Try to find appropriate moment for switching from star to delta configuration (*CONST11* in the circuit *Electrical Drive 1 - Star Delta*) for every value of the load torque. Observe the shape of the motor currents. Formulate conclusions related to the obtained results.

2. For the soft-start method observe waveforms of motor currents, fluxes, torque and speed (*Scopes – Softstart*) for three values of load torque (eg. 10%, 20%, 40% - could be set in the block *load_profile*). Try to find appropriate value of current limit to get the starting time shorter than 2.5 s (the parameter *Imax*, *CONST.1* in the circuit *Control system 2*). Observe the shape of the motor currents. Formulate conclusions related to the obtained results.

3. For the inverter method observe waveforms of motor currents, fluxes, torque and speed (*Scopes – Softstart*) for three values of load torque (eg. 10%, 40%, 70% - could be set in the block *load_profile*). Observe the impact of the rate of frequency change (parameter *f_req, CONST.5*, block *Freq_ramp* in the circuit *Control system 3*) to the start-up time and motor currents.). Observe the shape of the motor currents. Formulate conclusions related to the obtained results.

4. Compare obtained waveforms of the motor speed, electromagnetic torque and currents for two values of load torque (eg. 10%, 30%) of the three starting methods. Formulate conclusions related to the obtained results.