ttz-emo.thws

DC Motor - Part 3

Actuators - IRO6

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Example 3-5: Simulation model of the DC machine in Simulink

Slightly changed compared to script.

The simulation results of the class are to be verified with a Simulink model. The simulation models need to be built and further developed. The prepared files (syntax: `dcm<`*n*`>.slx`: Simulink model, `dcm<`*n*`>_init.m`: initialization routine in which the parameters for the simulation are set) can be accessed in e-Learning. The parameters are already preset as previously.

Example 3-5: Simulation model of the DC machine in Simulink

a. Create a simulation model in Simulink (`dcm1.slx`) with relative magnitudes as shown in class. As start point you can use the files `dcm1a.slx` and `dcm1a_init.m`. Both files are incomplete or even faulty.
   1. Check and correct the initialization parameters in `dcm1a_init.m`.
   2. Check and correct the parametrization of the amplifiers.
   3. Complete the missing connections.
   4. The model is prepared to simulate a load step from 0 to $0.5M_N$ at $t = 0$. Validate the model with this simulation.

Example 3-5: Simulation model of the DC machine in Simulink

b. Verify the results from class (`case_1.m`) with the model `dcm2.slx` (the initialization routine `[dcm]=dcm2_init.m` is called automatically when the simulation starts). Then carry out the simulation with a non-linear saturation characteristic. (The saturation characteristic curve is already stored in comment lines in the initialization routine.) What are the differences? Change the specifications (which ones?) so that the same speed results again in the steady state, even taking saturation into account.

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c. The DC motor should now be considered in controlled operation in the armature adjustment area. In the `dcm4.slx` model, the DC motor is combined as a subsystem and it is implemented together with the two PI controllers for speed and current control. The setpoint for the armature voltage is given directly to the input of the motor model. Compare the setpoint and actual value of the armature current during startup! Why are they different? Adjust the controller parameters (use your knowledge from control theory) and repeat the simulation!

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d. In the model `dcm5.slx` the field current controller is also taken into account. Verify the results from the class (`case_2.m`) without saturation. Then carry out the simulation with a non-linear saturation characteristic. Why is the speed control no longer able to set the setpoint in the field weakening range? What change needs to be made? (You can use `dcm5_init2.m` as help).