List of projects for the course in Electric Drives for Automation M (L. Zarri)

Updated 31/05/2013

The students are invited to choose one project of the following list. The students can form a group to carry out the project (no more than 3 people) .

1) Model of a drive based on interior permanent magnet machine (1 pt)

Design in Matlab/Simulink a model of an electric drive based on interior permanent magnet machine (speed control system, machine model, load model).

2) Model of a drive based on induction machine with torque disturbance compensator (2 pt)

Design in Matlab/Simulink a model of an electric drive based on induction machine (speed control system, machine model, load model) where the control system is able to compensate sinusoidal torque disturbances with a fixed frequency (and unknown phase angle)

$$T_{disturbance} = T_M \sin(\omega_{dist}\, t + \alpha)$$

3) Model of a drive based on permanent magnet machine with cogging torque disturbance compensator (4 pt)

Design in Matlab/Simulink a model of an electric drive based on a PM machine (speed control system, machine model, load model) where the control system is able to compensate sinusoidal torque disturbances depending on multiple of the rotor position (and unknown phase angle)

$$T_{disturbance} = T_M \sin(n\theta_{\mathrm{rotor}} t + \alpha)$$

4) Advanced model of a drive based on interior permanent magnet machine (3 pt)

Design in Matlab/Simulink a model of an electric drive based on interior permanent magnet machine (control system, machine model, load model) with one of the following additional feature:

- field-weakening capability;
- elastic coupling with the load.

5) Example of Internal Model Principle (1 pt)

Design in Matlab/Simulink a control system by using the Internal Model Principle for a plant with a first order transfer function, i.e.,

$$G(s) = \frac{1}{R + Ls}$$

in such a way that it is able to obtain zero-error at steady-state when the set-point signal is sinusoidal.

6) Example of Resonant Controller (1 pt)

Design in Matlab/Simulink a control system by using a resonant controller for a plant with a first order transfer function, i.e.,

$$G(s) = \frac{1}{R + Ls}$$

in such a way that it is able to obtain zero-error at steady-state when the set-point signal is sinusoidal.

7) Example of Dead-Beat Controller (1 pt)

Design in Matlab/Simulink a control system with a dead-beat controller for a plant with a first order transfer function, i.e.,

$$G(s) = \frac{1}{R + Ls}$$

in such a way that it is able to obtain zero-error at steady-state when the set-point signal is sinusoidal.

8) Example of Repetitive Controller (2 pt)
Design in Matlab/Simulink a control system by using a repetitive controller for a plant with a first order transfer function, i.e.,

$$G(s) = \frac{1}{R + Ls}$$

in such a way that it is able to obtain zero-error at steady-state when the set-point signal is

$$x(t) = X_M \sin(\omega t) + 0.5 X_M \sin(5\omega t) + 0.1 X_M \sin(7\omega t)$$

9) Model of a Active Rectifier (4 pt)
Design in Matlab/Simulink the model of a three-phase active rectifier to feed a constant load (model of the converter, control system, load).

10) Model of a Active Rectifier (4 pt)
Design in Matlab/Simulink the model of a three-phase active filter to feed a non-linear load (model of the converter, control system, load).

The students must decide suitable values for the system parameters.