Badji Mokhtar-Annaba University
Department of Electronics
3rd Year License in Automatique (S5)

Linear Systems Control (LSC)

TD 3

Exercise 1 :

We consider the electrical circuit above where Ve(t) represents the input voltage and Vs(t) the output voltage.

- Give the state representation of the electrical circuit.

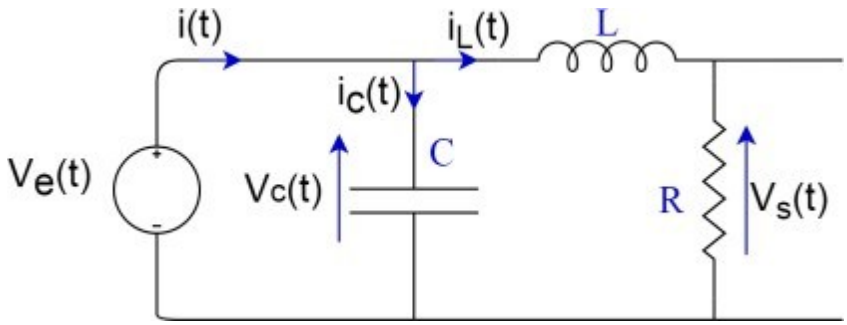

Figure 1- Electrical circuit

Exercise 2:

The figure below represents a direct current motor:

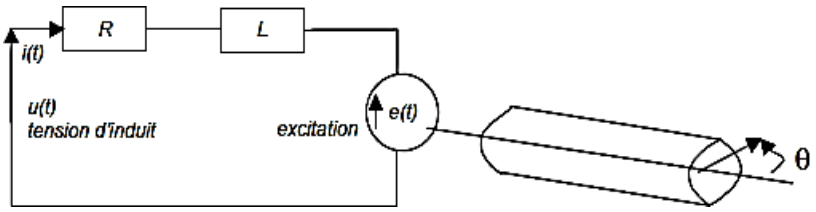

Figure 2- Direct current motor

We are given the electromechanical equations:

$$\begin{cases} u(t) = Ri(t) + L\frac{di}{dt} + e(t) \\ J\frac{d\omega}{dt} = C_m - f\omega - r\theta \\ e(t) = k_m\omega \\ C_m(t) = k_m i(t) \end{cases}$$

Where : $C_m(t)$ is the electromagnetic torque, f is the coefficient of viscous friction and r, k_m are coefficients.

1. If we choose: $[i \ w \ \theta]^T$ as a state vector, u(t) the armature voltage as input, θ as output (Y).

   Give the state and output equations of the system.

Exercise 3 :

Consider a system described by the following differential equation:

$$\ddot{y}(t) + 3\dot{y}(t) + 2y(t) = e(t)$$

The initial conditions are zero: $y(0) = \dot{y}(0) = 0$.

1. Determine the transfer function of the system and its poles.
2. Give its state representation in companion form for the command, calculate its eigenvalues.
3. Give your state representation in modal form.
4. Find its transfer function from the modal form.

Exercise 4 :

We consider an electromechanical system represented by the diagram below.

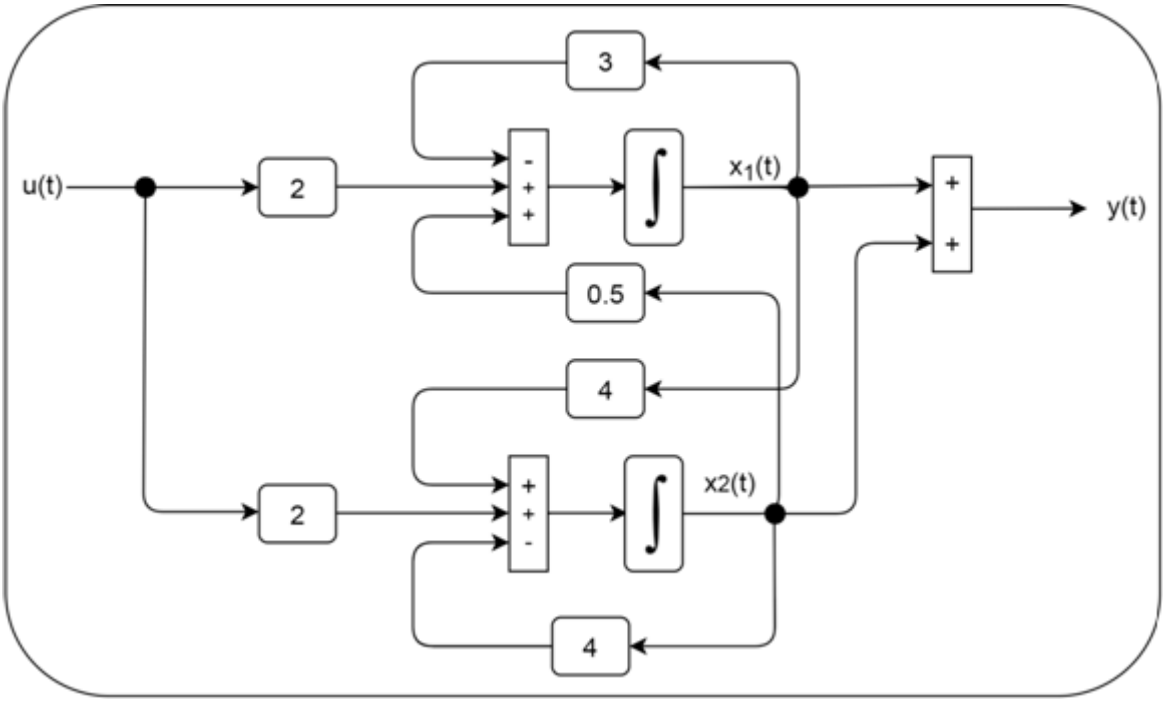

Figure 3 : Functional diagram of an electromechanical system.

1- Determine the system state model.