Control y Automatización – IOI
2º Semestre, 2019
Problemas #1

1. Plantea y resuelve la ecuación diferencial del sistema de la Fig.1 para $v(t) = u(t)$ (función escalón unidad). Representa gráficamente la solución. ($R = 2\Omega$; $L = 1$H; $1/LC = 25$; condiciones iniciales: $i(0 = 0)$; $v_L(0) = 1$)

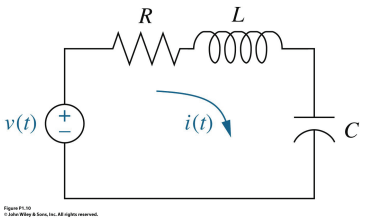

Figure 1:

TABLE 2.3 Voltage-current, voltage-charge, and impedance relationships for capacitors, resistors, and inductors

Component	Voltage-current	Current-voltage	Voltage-charge	Impedance $Z(s) = V(s)/I(s)$	Admittance $Y(s) = I(s)/V(s)$
Capacitor	$v(t) = \frac{1}{C}\int_0^t i(\tau)d\tau$	$i(t) = C\frac{dv(t)}{dt}$	$v(t) = \frac{1}{C}q(t)$	$\frac{1}{Cs}$	Cs
Resistor	$v(t) = Ri(t)$	$i(t) = \frac{1}{R}v(t)$	$v(t) = R\frac{dq(t)}{dt}$	R	$\frac{1}{R} = G$
Inductor	$v(t) = L\frac{di(t)}{dt}$	$i(t) = \frac{1}{L}\int_0^t v(\tau)d\tau$	$v(t) = L\frac{d^2q(t)}{dt^2}$	Ls	$\frac{1}{Ls}$

Note: The following set of symbols and units is used throughout this book: $v(t)$ – V (volts), $i(t)$ – A (amps), $q(t)$ – Q (coulombs), C – F (farads), R – Ω (ohms), G – Ω (mhos), L – H (henries).

Table 2.3

Figure 2:

2. Resuelve las siguientes ecuaciones diferenciales:

   (a)
   $$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 2x = \sin 2t; \;\; x(0) = 2; \;\; \frac{dx}{dt}(0) = -3$$

   (b)
   $$\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 8x = 5\sin 3t$$
   (asumir condiciones iniciales igual a cero)

   (c)
   $$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + x = 5e^{-2t} + t; \;\; x(0) = 2; \;\; \frac{dx}{dt}(0) = 1$$