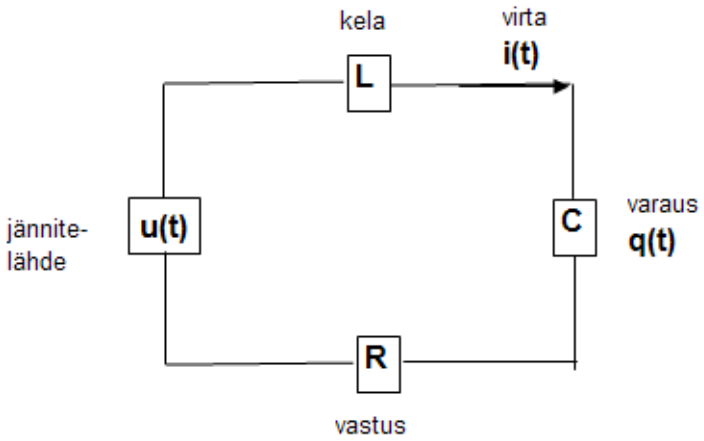
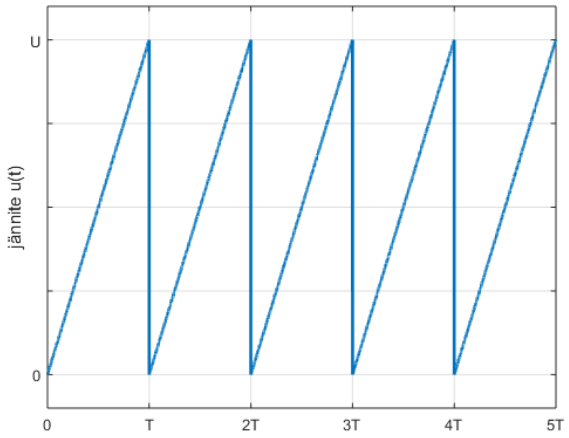
1. (RLC-circuit) Use SIMULINK to draw the graphs

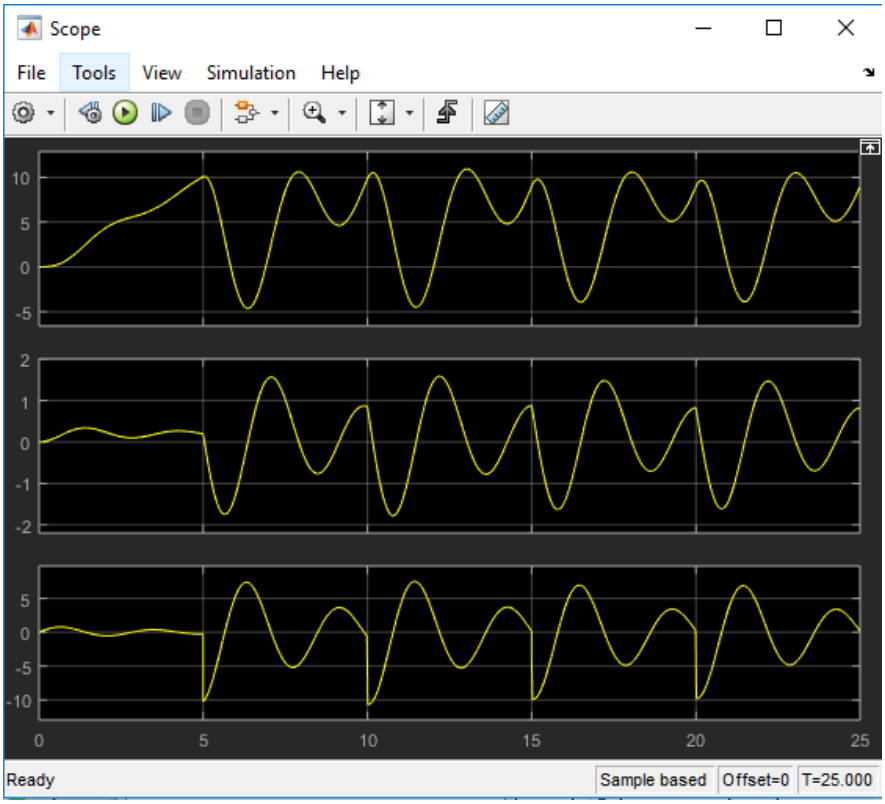


of the voltages

$$U_C = q(t)/C,\ U_R = R\,i(t),\ \text{ ja }\ U_L = L\,i'(t)$$

on the interval $t = 0 \ldots 5T$, when $u(t)$ is the saw tooth below (and for example, $L = 2, R = 1, C = 0.1, U = 10$ ja $T = 5$)





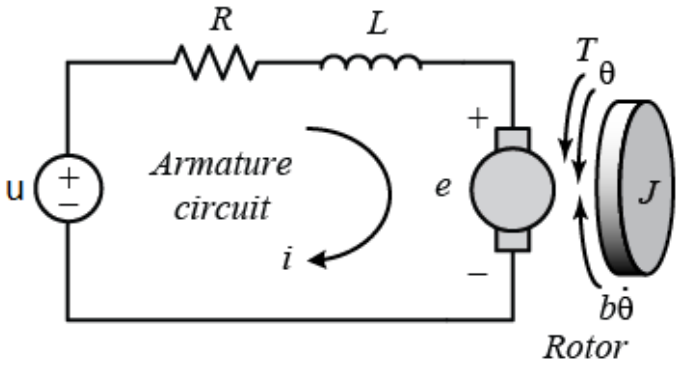
ohje: differential equation

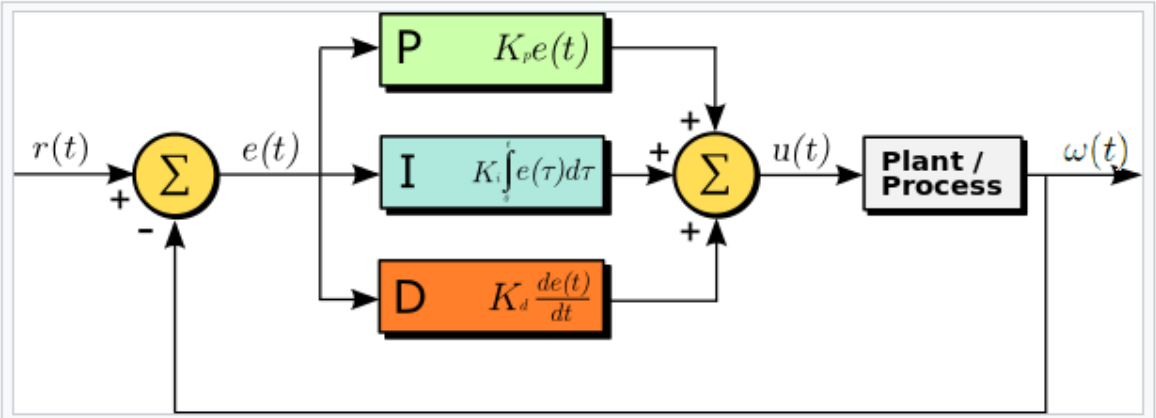
$$L \cdot q''(t) + R \cdot q'(t) + \frac{1}{C} \cdot q(t) = u(t), \quad q(0) = 0,\ q'(0) = 0$$

multiplication by a number: block Gain from math operations
differentiation: block Derivative from continuous

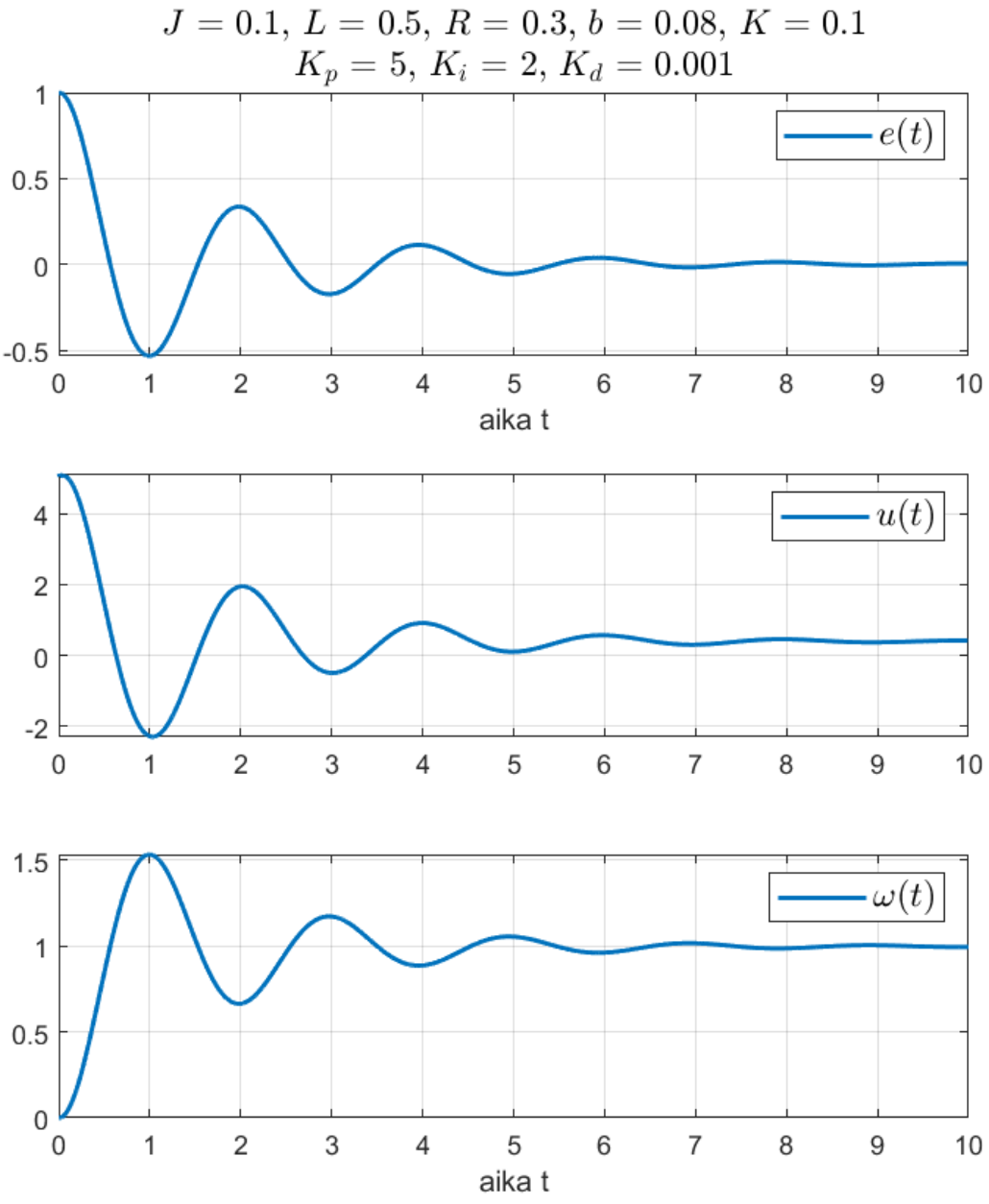
2. (DC-motor) Use SIMULINK to draw the graphs of $e(t), u(t)$ and $\omega(t)$, when $r(t) = 1$ and the differential equation is

$$JL\,\omega''(t) + (RJ + bL)\,\omega'(t) + (bR + K^2)\,\omega(t) = K\,u(t)$$





A block diagram of a PID controller in a feedback loop. *r*(*t*) is the desired process value or setpoint (SP), and *y*(*t*) is the measured process value (PV).


$J = 0.1,\ L = 0.5,\ R = 0.3,\ b = 0.08,\ K = 0.1$
$K_p = 5,\ K_i = 2,\ K_d = 0.001$
$e(t)$
$u(t)$
$\omega(t)$
aika t
aika t