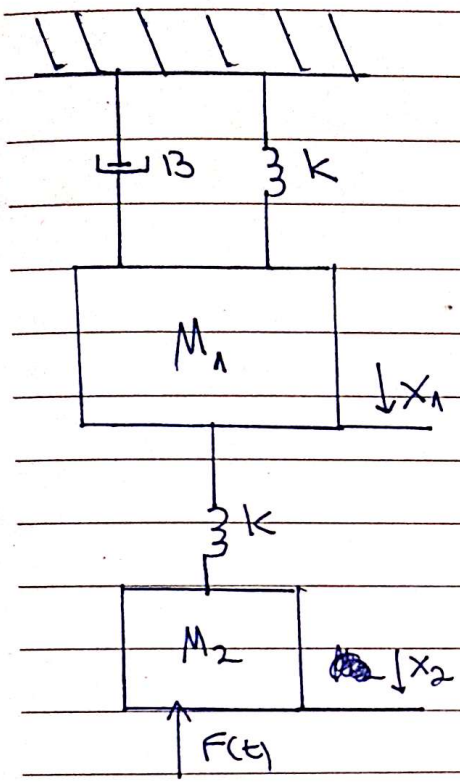
Str. 18

6.



$t = [0, 20]$

$x_1 = x_2 = 0$

$G = m \cdot g$

$M_1 = 2\,[kg]$

$M_2 = 1\,[kg]$

$k = 3\,[N/m]$

$B = 2\,[Ns/m]$

$F(t) = 10\sin(t)$

$$-M_1 x_1'' - B x_1' - k x_1 + M_1 g + k(x_2 - x_1) = 0$$

$$-M_2 x_2'' - k(x_2 - x_1) + M_2 g - F(t) = 0$$

$$-M_1 x_1'' - B x_1' - k x_1 = -M_1 g$$

$$-M_2 x_2'' = F(t) - M_2 g$$

$$M_1 x_1'' + B x_1' + k x_1 = M_1 g \quad / : M_1$$

$$M_2 x_2'' = M_2 g - F(t) \quad / : M_2$$

$$x_1'' + \frac{B}{M_1} x_1' + \frac{k}{M_1} x_1 = g$$

$$x_2'' = g - \frac{F(t)}{M_2}$$

Datum/Date Bilješke/Notes

$x_1'' + x' + \frac{3}{2}x = 9{,}81 \rightarrow x'' = 9{,}81 - x' - \frac{3}{2}x$

$x_2'' = 9{,}81 - 10\sin t$

$s^2 X_1(s) + sX_1(s) + \frac{3}{2}X_1(s) = \frac{9{,}81}{s}$

$s^2 X_2(s) = \frac{9{,}81}{s} - 10\frac{1}{s^2+1}$

$X_1(s)\left(s^2 + s + \frac{3}{2}\right) = \frac{9{,}81}{s}$

$X_1(s) = \frac{9{,}81}{s\left(s^2+s+\frac{3}{2}\right)}$

$\frac{9{,}81}{s\left(s^2+s+\frac{3}{2}\right)} = \frac{A}{s} + \frac{Bs+C}{s^2+s+\frac{3}{2}}$

$9{,}81 = A\left(s^2+s+\frac{3}{2}\right) + s(Bs+C)$

$9{,}81 = As^2 + As + \frac{3}{2}A + Bs^2 + Cs$

$9{,}81 = s^2(A+B) + s(A+C) + \frac{3}{2}A$

$A+B=0 \qquad A+C=0 \qquad \frac{3}{2}A = 9{,}81$

$B=-A \qquad C=-A \qquad 3A = 19{,}62$

$B=-6{,}54 \qquad C=-6{,}54 \qquad A=6{,}54$

$\frac{9{,}81}{s\left(s^2+s+\frac{3}{2}\right)} = \frac{6{,}54}{s} + \frac{-6{,}54s - 6{,}54}{s^2+s+\frac{3}{2}}$

Datum/Date

Bilješke/Notes

$$\frac{9,81}{s\left(s^2+s+\frac{3}{2}\right)} = 6,54\frac{1}{s} + \frac{-6,54s-6,54}{\left(s+\frac{1}{2}\right)^2+\left(\frac{\sqrt{5}}{2}\right)^2}$$

$$x_1(t) = 6,54 - 6,54e^{-\frac{1}{2}t}\cos\frac{\sqrt{5}}{2}t - 2,92e^{-\frac{1}{2}t}\sin\frac{\sqrt{5}}{2}t$$

$$\frac{-6,54s-6,54}{\left(s+\frac{1}{2}\right)^2+\left(\frac{\sqrt{5}}{2}\right)^2} = \frac{-6,54\left(\left(s+\frac{1}{2}\right)-\frac{1}{2}\right)-6,54}{\left(s+\frac{1}{2}\right)^2+\left(\frac{\sqrt{5}}{2}\right)^2}$$

$$= \frac{-6,54\left(s+\frac{1}{2}\right)-3,27}{\left(s+\frac{1}{2}\right)^2+\left(\frac{\sqrt{5}}{2}\right)^2}$$

$$= -6,54\frac{s+\frac{1}{2}}{\left(s+\frac{1}{2}\right)^2+\left(\frac{\sqrt{5}}{2}\right)^2} = -6,54e^{-\frac{1}{2}t}\cos\frac{\sqrt{5}}{2}t$$

$$= -3,27\frac{1}{\left(s+\frac{1}{2}\right)^2+\left(\frac{\sqrt{5}}{2}\right)^2} = -3,27\frac{\frac{\sqrt{5}}{2}\cdot\frac{2}{\sqrt{5}}}{\left(s+\frac{1}{2}\right)^2+\left(\frac{\sqrt{5}}{2}\right)^2}$$

$$= -2,92e^{-\frac{1}{2}t}\sin\frac{\sqrt{5}}{2}t$$

$$s^2X_2(s) = \frac{9,81}{s} - \frac{10}{s^2+1}$$

$$s^2X_2(s) = \frac{9,81s^2-10s+9,81}{s(s^2+1)}$$

$$X_2(s) = \frac{9,81s^2-10s+9,81}{s^3(s^2+1)}$$

$$\frac{9{,}81s^2-10s+9{,}81}{s^3(s^2+1)} = \frac{A}{s} + \frac{B}{s^2} + \frac{C}{s^3} + \frac{Ds+E}{s^2+1}$$

$$9{,}81s^2-10s+9{,}81 = As^2(s^2+1) + Bs(s^2+1) + C(s^2+1) + s^3(Ds+E)$$

$$9{,}81s^2-10s+9{,}81 = As^4+As^2+Bs^3+Bs+Cs^2+C+Ds^4+Es^3$$

$$9{,}81s^2-10s+9{,}81 = s^4(A+D)+s^3(B+E)+s^2(A+C)+Bs+C$$

$A+D=0$ $\quad B+E=0$ $\quad A+C=9{,}81$ $\quad Bs=-10$ $\quad C=9{,}81$

$D=0$ $\quad E=10$ $\quad A=0$

$$\frac{9{,}81s^2-10s+9{,}81}{s^3(s^2+1)} = -\frac{10}{s^2} + \frac{9{,}81}{s^3} + \frac{10}{s^2+1}$$

$$x_2(t) = -10t + \frac{9{,}81t^2}{2} + 10\sin t$$