Task 9 Khaetskaya Daria

1) $T = 2t_1 \quad \omega_0 = \frac{2\pi}{T} = \frac{\pi}{t_1}$

$$f(t) = U_m \sin\omega_0 t (1(t) - 1(t-t_1)) = U_m \sin\frac{\pi t}{t_1}\left(1(t) - 1(t-t_1)\right) =$$

$$= U_m\left(\sin\frac{\pi t}{t_1}\cdot 1(t) - \sin\frac{\pi t}{t_1} 1(t-t_1)\right) = U_m\left(\sin\frac{\pi t}{t_1}\cdot 1(t) -\right.$$

$$\left. - \sin\left(\frac{\pi(t+t_1-t_1)}{t_1}\right)\cdot 1(t-t_1)\right) = U_m\left(\sin\frac{\pi t}{t_1}\cdot 1(t) + \sin\left(\frac{\pi(t-t_1)}{t_1}\right)\cdot 1(t-t_1)\right) =$$

$$\doteqdot U_m \frac{\pi}{t_1}\cdot\frac{1}{s^2+\left(\frac{\pi}{t_1}\right)^2}\cdot\left(1+e^{-st_1}\right)$$

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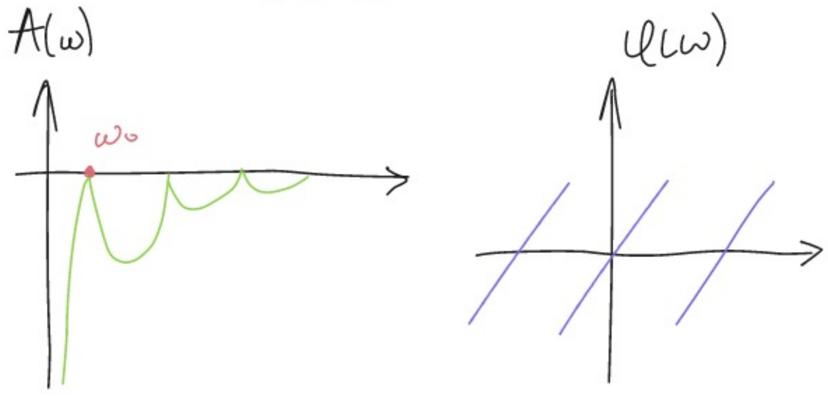
$$S(j\omega) = \frac{U_m \pi}{t_1\left((j\omega)^2+\left(\frac{\pi}{t_1}\right)^2\right)}\left(1+e^{-j\omega t}\right) = \frac{U_m \pi}{t_1\left((j\omega)^2+\left(\frac{\pi}{t_1}\right)^2\right)}\left(1+\cos\omega t_1 - j\sin\omega t_1\right) =$$

$$= \frac{U_m \pi}{t_1\left((j\omega)^2+\left(\frac{\pi}{t_1}\right)^2\right)}\left((1+\cos\omega t_1)^2 + \sin^2\omega t_1\right)^{\frac{1}{2}}\cdot e^{-j\,\mathrm{arctg}\frac{\sin\omega t_1}{1+\cos\omega t_1}} =$$

$$= \underbrace{\frac{U_m \pi}{t_1\left((j\omega)^2+\left(\frac{\pi}{t_1}\right)^2\right)}\sqrt{2+2\cos\omega t_1}}_{A(\omega)}\cdot e^{-j\,\overbrace{\mathrm{arctg}\frac{\sin\omega t_1}{1+\cos\omega t_1}}^{\varphi(\omega)}}$$



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$$f(t)=\sum_{k=-\infty}^{+\infty} C_k e^{jk\omega t} \quad , \dot{C}_k=\frac{\omega_0}{2\pi}F(s)\Big|_{s=jk\omega_0}$$

$$F(s)=U_m\frac{\pi}{t_1}\ \frac{1+e^{-t_1 s}}{\left(\frac{\pi}{t_1}\right)^2+s^2}$$

$$\cos(-k\pi)+j\sin(k\pi)=\cos(k\pi)=(-1)^k$$

$$\dot{C}_k=\frac{\pi}{2\pi t_1}U_m\frac{\pi}{t_1}\ \frac{1+e^{-jt_1\frac{\pi k}{t_1}}}{\left(\frac{\pi}{t_1}\right)^2+\left(jk\frac{\pi}{t_1}\right)^2}=\frac{U_m}{2\pi}\cdot\frac{1+e^{-jk\pi}}{1-k^2}=\frac{U_m\left(1+(-1)^k\right)}{2\pi\left(1-k^2\right)}$$

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2) $T=t_1 \quad \omega_0=\frac{2\pi}{T}=\frac{2\pi}{t_1}$

$$f(t)=U_m\sin\omega_0 t\left(1(t)-1(t-t_1)\right)=U_m\sin\frac{2\pi t}{t_1}\left(1(t)-1(t-t_1)\right)=$$

$$=U_m\left(\sin\frac{2\pi t}{t_1}\cdot 1(t)-\sin\frac{2\pi t}{t_1}1(t-t_1)\right)=U_m\left(\sin\frac{2\pi t}{t_1}\cdot 1(t)-\right.$$

$$\left.-\sin\left(\frac{2\pi(t+t_1-t_1)}{t_1}\right)\cdot 1(t-t_1)\right)=U_m\left(\sin\frac{2\pi t}{t_1}\cdot 1(t)+\sin\left(2\pi\frac{(t-t_1)}{t_1}\right)\cdot 1(t-t_1)\right)=$$

$$\doteq U_m\frac{2\pi}{t_1}\cdot\frac{1}{s^2+\left(\frac{2\pi}{t_1}\right)^2}\cdot\left(1+e^{-st_1}\right)$$

$$\cos(-2\pi k)+j\underbrace{\sin(-2\pi k)}_{=0}=1$$

$$\dot{C}_k=\frac{2\pi}{t_1}\cdot\frac{1}{2\pi}U_m\frac{\pi}{t_1}\ \frac{1+e^{-jt_1\frac{2\pi k}{t_1}}}{\left(\frac{2\pi}{t_1}\right)^2+\left(jk\frac{2\pi}{t_1}\right)^2}=\frac{\pi}{t_1^2}U_m\ \frac{t_1^2}{(2\pi)^2}\ \frac{1+e^{-j2\pi k}}{1-k^2}=$$

$$=\frac{1}{4\pi}\ \frac{2U_m}{1-k^2}$$

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