b) $u(t) = \hat{u} \cdot \sin(\omega t)$

1. $\bar{u} = \frac{1}{T} \int_0^{T/2} \hat{u} \cdot \sin(\omega t) dt = \frac{\hat{u}}{T} \int_0^{T/2} \sin(\omega t) dt$

$\bar{u} = \frac{\hat{u}}{T} \cdot \left[\frac{-\cos(\omega t)}{\omega} \right]_0^{T/2} = \frac{\hat{u}}{T \cdot \omega} \cdot \left[-\cos\left(\frac{2\pi}{T} \cdot \frac{T}{2}\right) + \cos(0) \right]$

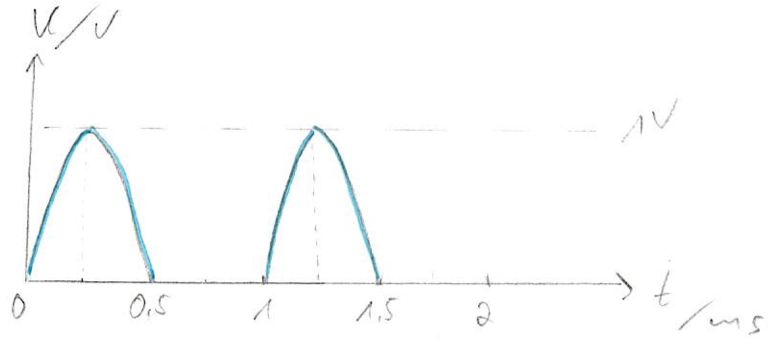
$\underline{\underline{\bar{u}}} = \frac{1V}{T \cdot \frac{2\pi}{T}} \cdot 2 = \frac{1V}{\pi} = \underline{\underline{0{,}3183V}} \rightarrow$ Mittelwert

2. $U_{eff} = \sqrt{\frac{1}{T} \cdot \int_0^{T/2} (\hat{u} \cdot \sin(\omega t))^2 dt} = \sqrt{\frac{\hat{u}^2}{T} \int_0^{T/2} \frac{1}{2}(1 - \cos(2\omega t)) dt}$

$U_{eff} = \sqrt{\frac{\hat{u}^2}{T \cdot 2} \int_0^{T/2} 1 - \cos(2\omega t) dt} = \sqrt{\frac{\hat{u}^2}{T \cdot 2} \left[t - \frac{\sin(2\omega t)}{2\omega} \right]_0^{T/2}}$

$U_{eff} = \sqrt{\frac{\hat{u}^2}{T \cdot 2} \cdot \left[\left(\frac{T}{2} - \frac{\sin\left(2 \cdot \frac{2\pi}{T} \cdot \frac{T}{2}\right)}{2 \cdot \omega} \right) - \left(0 - \frac{\sin(0)}{2\omega} \right) \right]}$

$U_{eff} = \sqrt{\frac{\hat{u}^2}{T \cdot 2} \cdot \frac{T}{2}} = \sqrt{\frac{\hat{u}^2}{4}} = \frac{1V}{\sqrt{4}}$



c) $u = \hat{u} \cdot \sin(\omega t)$

1. $$\bar{u} = \frac{1}{T}\int_0^{T/3} \hat{u}\cdot\sin(\omega t)\,dt = \frac{\hat{u}}{T}\int_0^{T/3}\sin(\omega t)\,dt = \frac{\hat{u}}{T}\cdot\left[\frac{-\cos(\omega t)}{\omega}\right]_0^{T/3}$$

$$\bar{u} = \frac{\hat{u}}{T}\cdot\left(\frac{-\cos\left(\frac{2\pi}{T}\cdot\frac{T}{3}\right)}{\frac{2\pi}{T}} + \frac{\cos(0)}{\frac{2\pi}{T}}\right) = \frac{\hat{u}}{\cancel{T}\cdot\frac{2\pi}{\cancel{T}}}(0{,}5+1)$$

$$\underline{\underline{\bar{u}}} = \frac{\hat{u}}{2\pi}\cdot 1{,}5 = \frac{1V}{2\pi}\cdot 1{,}5 = \underline{\underline{0{,}2387V}}$$

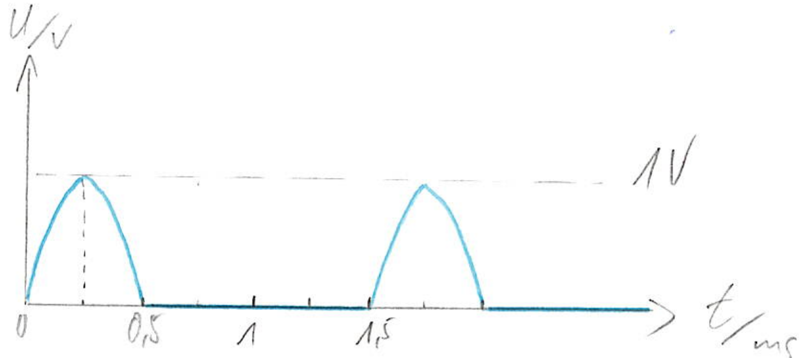
2. $$U_{eff} = \sqrt{\frac{1}{T}\int_0^{T/3}(\hat{u}\cdot\sin(\omega t))^2\,dt} = \sqrt{\frac{\hat{u}^2}{T}\int_0^{T/3}\frac{1}{2}(1-\cos(2\omega t))\,dt}$$

$$U_{eff} = \sqrt{\frac{\hat{u}^2}{T\cdot 2}\cdot\int_0^{T/3} 1-\cos(2\omega t)\;dt} = \sqrt{\frac{\hat{u}^2}{T\cdot 2}\cdot\left[t-\frac{\sin(2\omega t)}{2\omega}\right]_0^{T/3}}$$

$$U_{eff} = \sqrt{\frac{\hat{u}^2}{T\cdot 2}\cdot\left[\left(\frac{T}{3}-\frac{\sin\left(2\cdot\frac{2\pi}{T}\cdot\frac{T}{3}\right)}{2\omega}\right)-\left(0-\frac{\sin(0)}{2\omega}\right)\right]}$$

$$U_{eff} = \sqrt{\frac{\hat{u}^2}{T\cdot 2}\cdot\left(\frac{T}{3}-\frac{\frac{\sqrt{3}}{2}}{2\cdot\frac{2\pi}{T}}\right)} = \sqrt{\frac{\hat{u}^2}{6}-\frac{\hat{u}^2\cdot\frac{\sqrt{3}}{2}}{\cancel{T}\cdot 2\cdot\frac{4\pi}{\cancel{T}}}} = \sqrt{\frac{\hat{u}^2}{6}-\frac{\hat{u}^2\cdot\frac{\sqrt{3}}{2}}{8\pi}}$$

$$\underline{\underline{U_{eff}}} = \sqrt{\frac{(1V)^2}{6}-\frac{(1V)^2\cdot\frac{\sqrt{3}}{2}}{8\pi}} = \underline{\underline{0{,}3636V}}$$



d) $\bar{u} = \frac{1}{T}\left(\int_0^{T/2} \hat{u}\cdot 2t\,dt - \int_{T/2}^{T} \hat{u} 2t\,dt\right) = \frac{\hat{u}}{T}\left([t^2]_0^{T/2} - [t^2]_{T/2}^{T}\right)$

$= \frac{\hat{u}}{T}\cdot\left(\left(\frac{T^2}{4}-0\right) - \left(T^2 + \frac{T^2}{4}\right)\right) = \frac{\hat{u}}{T}\cdot\left(-\frac{T^2}{2}\right) = -\frac{1V\cdot T}{2}$

$\underline{\underline{\bar{u} = -1\,mVs}}$ → muss sich Sekundeneinheit sich nicht in der Rechnung wegkürzen

$$u_{eff} = \sqrt{\frac{\hat{u}^2}{T}\left(\int_0^{T/2} (2t)^2\,dt - \int_{T/2}^{T} (2t)^2\,dt\right.}$$

$$= \sqrt{\frac{\hat{u}^2}{T}\left(\int_0^{T/2} 4t^2\,dt - \int_{T/2}^{T} 4t^2\,dt\right)}$$

$$= \sqrt{\frac{\hat{u}^2}{T}\left(\left[\frac{4}{3}t^3\right]_0^{T/2} - \left[\frac{4}{3}t^3\right]_{T/2}^{T}\right)}$$

$$= \sqrt{\frac{\hat{u}^2}{T}\left(\left[\frac{4}{3}\cdot\frac{T^3}{8} - 0\right] + \left[-\frac{4}{3}T^3 + \frac{4}{3}\cdot\frac{T^3}{8}\right]\right.}$$

$$= \sqrt{\frac{\hat{u}^2}{T}\left(\frac{T^3}{6} - \frac{4T^3}{3} + \frac{T^3}{6}\right)}$$

$$= \sqrt{\frac{u^2}{T}\cdot\left(\frac{2T^3}{6} - \frac{8T^3}{6}\right)} = \sqrt{\frac{\hat{u}^2}{T}\cdot - T^3} = \hat{u}\cdot\sqrt{-T^2}$$