

# task\_abh4vhlgczdbni37\_with\_calculation

## Student Group

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## signal analysis, RMS, exam ee2 SS2021

**Exercise E18 Signal Analysis****(written test, approx. 6 % of a 120-minute written test, SS2021)**

A) Determine the effective value of the signal  $i(t)$  and the phase angle  $\varphi$  (in degrees) if the quantities are available in the consumer arrow system. (hard)

- $u(t) = 50 \sqrt{2} \cos(6000 t + 4)$  V

- $i(t) = 30 \sqrt{2} \sin(6000 t + 5)$  A

Result

a) Determine the amplitude values  $\hat{U}$ ,  $\hat{I}$  and the RMS values  $U$ ,  $I$

- $f = 955$  Hz

- $\hat{U} = 50 \sqrt{2}$  V

The frequency can be derived by the term in the sine function:  $\omega = 6000$  rad/s

- $\hat{I} = 30 \sqrt{2}$  A

- $f = \frac{\omega}{2\pi} = \frac{6000}{2\pi} = 954.93 \dots$  Hz

RMS values:

For the phase  $\varphi$ , we have to subtract  $\varphi_i$  from  $\varphi_u$ .

But to get these values, both the  $u(t)$  and  $i(t)$  need to have the same sinusoidal function! Therefore:

- $U = 35.41$  V
- The amplitude values  $\hat{U}$ ,  $\hat{I}$  are given directly by the coefficient of the cosine and sine functions

- For the RMS values of sinusoidal functions the amplitudes have to be multiplied with  $\frac{1}{\sqrt{2}}$

- $\varphi = 4 - 5 = -1$  rad

By this we get for  $\varphi$  
$$\varphi = \varphi_u - \varphi_i = 4 - 5 = -1 \text{ rad} = -57.2958 \dots^\circ$$

Converted in degree: 
$$\varphi = -1 \cdot \frac{360^\circ}{2\pi} = -57.2958 \dots^\circ$$

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