

rechnung_betragundphase_umkehrintegrator

Student Group

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\$\;\$ \$\;\$ \$\;\$	$U_{\rm O} = -\{1 \over R \cdot C\} \cdot \int_{t_0}^{t_1} \color{blue}{U_{\rm I}(t)} \, dt + U_{\rm O0}$
\$\;\$ \$\;\$ \$\;\$	insert sine function: $\color{blue}{U_{\rm I}(t)} = \hat{U}_{\rm I} \cdot \sin(\omega \cdot t)$
\$\;\$ \$\;\$ \$\;\$	$U_{\rm O} = -\{1 \over R \cdot C\} \cdot \int_{t_0}^{t_1} \hat{U}_{\rm I} \cdot \sin(\omega \cdot t) \, dt + U_{\rm O0}$
\$\;\$ \$\;\$ \$\;\$	insert root function with limits $\color{blue}{\int_{x_0}^{x_1} \sin(a \cdot x) \, dx} = [-1 \over a] \cdot \cos(a \cdot x) \Big _{x_0}^{x_1}$
\$\;\$ \$\;\$ \$\;\$	$U_{\rm O} = -\{1 \over R \cdot C\} \cdot [-\color{blue}{\hat{U}_{\rm I} \over \omega} \cdot \cos(\omega \cdot t)]_{t_0}^{t_1} + U_{\rm O0}$
\$\;\$ \$\;\$ \$\;\$	put constant before integral $U_{\rm O} = \{1 \over R \cdot C\} \cdot \{\hat{U}_{\rm I} \over \omega\} \cdot \color{blue}{[\cos(\omega \cdot t)]_{t_0}^{t_1}} + U_{\rm O0}$
\$\;\$ \$\;\$ \$\;\$	insert limits: \$t_0=0\$, \$t_1=t\$ $U_{\rm O} = \{\color{blue}{\hat{U}_{\rm I} \over \omega}\} \cdot \color{blue}{[\cos(\omega \cdot t) - \cos(0)]} + U_{\rm O0}$
\$\;\$ \$\;\$ \$\;\$	$\color{blue}{\cos(0)} = 1$
\$\;\$ \$\;\$ \$\;\$	$U_{\rm O} = \color{blue}{\{\hat{U}_{\rm I} \over \omega\}} \cdot \color{blue}{[\cos(\omega \cdot t) - 1]} + U_{\rm O0}$
\$\;\$ \$\;\$ \$\;\$	multiply $U_{\rm O} = \{\hat{U}_{\rm I} \over \omega\} \cdot \color{blue}{[\cos(\omega \cdot t) - 1]} + U_{\rm O0}$
\$\;\$ \$\;\$ \$\;\$	consider the non-cosine terms: The blue part is independent in time. We assume purely sinusoidal quantities!
\$\;\$ \$\;\$ \$\;\$	$U_{\rm O} = \{\hat{U}_{\rm I} \over \omega\} \cdot \color{blue}{[\cos(\omega \cdot t) - 1]} + U_{\rm O0}$
\$\;\$ \$\;\$ \$\;\$	\$\rightarrow\$ initial voltage of the capacitor: $U_{\rm C0} = U_{\rm O0} = \{\hat{U}_{\rm I} \over \omega\} \cdot \color{blue}{[\cos(\omega \cdot t) - 1]} + U_{\rm O0}$
\$\;\$ \$\;\$ \$\;\$	$U_{\rm O} = \{\hat{U}_{\rm I} \over \omega\} \cdot \color{blue}{[\cos(\omega \cdot t) - 1]} + U_{\rm O0}$

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