

rechnung_betragundphase_umkehrintegrator

Student Group

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\$\;\$	\$U_A = -\{ 1 \over {R \cdot C} \} \cdot \int_{t_0}^{t_1} \color{blue}{U_E(t)} \, dt + U_{A0}\$
\$\;\$	insert sine function: $\color{blue}{U_E(t)} = \hat{U}_E \cdot \sin(\omega \cdot t)$
\$\;\$	$\color{blue}{U_E(t)} = \hat{U}_E \cdot \sin(\omega \cdot t)$
\$\;\$	\$U_A = -\{ 1 \over {R \cdot C} \} \cdot \int_{t_0}^{t_1} \color{blue}{\hat{U}_E \cdot \sin(\omega \cdot t)} \, dt + U_{A0}\$
\$\;\$	insert root function with limits $\color{blue}{\int_{x_0}^{x_1} \sin(a \cdot x) \, dx} = [-\{ 1 \over a \} \cdot \cos(a \cdot x)]_{x_0}^{x_1}$
\$\;\$	$U_A = -\{ 1 \over {R \cdot C} \} \cdot [-\color{blue}{\hat{U}_E \over \omega} \cdot \cos(\omega \cdot t)]_{t_0}^{t_1} + U_{A0}$
\$\;\$	put constant before integral
\$\;\$	$U_A = \{ \color{blue}{\hat{U}_E \over \omega} \cdot \cos(\omega \cdot t) \}_{t_0}^{t_1} + U_{A0}$
\$\;\$	insert limits: $t_0=0, t_1=t$
\$\;\$	$U_A = \{ \color{blue}{\hat{U}_E \over \omega} \cdot \cos(\omega \cdot t) - \color{blue}{\cos(0)} \} + U_{A0}$
\$\;\$	$\color{blue}{\cos(0)} = 1$
\$\;\$	$U_A = \color{blue}{\{ \hat{U}_E \over \omega} \cdot \cos(\omega \cdot t) - 1 \}} + U_{A0}$
\$\;\$	multiply
\$\;\$	$U_A = \{ \color{blue}{\hat{U}_E \over \omega} \cdot \cos(\omega \cdot t) - \color{blue}{\{ \hat{U}_E \over \omega} \}} + U_{A0}$
\$\;\$	consider the non-cosine terms: The blue part is independent in time. We assume purely sinusoidal quantities!
\$\;\$	$U_A = \{ \color{blue}{\hat{U}_E \over \omega} \cdot \cos(\omega \cdot t) - \color{blue}{\{ \hat{U}_E \over \omega} \}} + U_{A0}$
\$\;\$	Therefore, the initial voltage of the capacitor must be: $U_{C0} = U_{A0} = \{ \color{blue}{\hat{U}_E \over \omega} \}$
\$\;\$	$U_A = \{ \color{blue}{\hat{U}_E \over \omega} \cdot \cos(\omega \cdot t) \}$
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