rechnung_betragundphase_umkehrintegrator

Student Group

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Table of Contents

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