

# rechnung\_betragundphase\_umkehrintegrator

## Student Group

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

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