

ECE 201: Lecture 29

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- Phasors

Phasors

- A sinusoidal signal (voltage or current) can always be expressed as $x(t) = A_x \cos(\omega t + \theta)$ or, equivalently $x(t) = \text{Re}\{\tilde{X} e^{j\omega t}\}$ where $\tilde{X} = A_x e^{j\theta}$
- \tilde{X} is a complex number known as the PHASOR corresponding to $x(t)$
 - The magnitude of \tilde{X} is the same as the amplitude (maximum value) of $x(t)$
 - The phase of \tilde{X} is the same as that of $x(t)$, i.e., the real part of \tilde{X} is equal to $x(0)$
 - Phasors do not depend on time
- We can go back and forth between phasors and time signals:
 - if $x(t) = A_x \cos(\omega t + \theta)$ then $\tilde{X} = A_x e^{j\theta}$
 - $x(t) = \text{Re}\{\tilde{X} e^{j\omega t}\}$

Circuit elements

- We have studied three main circuit elements (op amps have to be dealt with separately): R, L, and C
- Each characterized in terms of an equation relating its voltage drop with its current:
 - R gave Ohm's law: $V(t) = R \cdot I(t)$
 - L gave $V_L(t) = L \frac{d i_L(t)}{dt}$
 - C gave $i_C(t) = C \frac{d v_C(t)}{dt}$
- We can always use these to analyze the circuit, but when all the inputs are sinusoidal, these equations can be significantly simplified