Connexions module: m21473

PHASORS: NUMERICAL EXPERIMENT (INTERFERENCE PATTERNS)*

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Let's add two sinusoids whose amplitudes and frequencies are identical and whose phases are different:

$$x(t) = A\cos(\omega t + \phi) + A\cos(\omega t + \phi + \psi). \tag{1}$$

Show analytically that this sum has the phasor representation

$$X = 2A \cos\left(\frac{\psi}{2}\right) e^{j[\phi + (\psi/2)]}.$$
 (2)

Interpret this finding. Then write a MATLAB program that computes and plots complex X on the complex plane as ψ varies from 0 to 2π and that plots magnitude, |X|, and phase, argX, versus the phase angle ψ . (You will have to choose $\psi = n\frac{2\pi}{N}, n = 0, 1, ..., N-1$, for a suitable N.) When do you get constructive interfelence and when do you get destructive interference? Now compute and plot x(t) versus t (you will need to discretize t) for several interesting values of ψ . Explain your interference results in terms of the amplitude and phase of x(t) and the magnitude and phase of X. Use the subplots discussed in "An Introduction to MATLAB" to plot all of your results together.

^{*}Version 1.6: Sep 17, 2009 11:23 am -0500

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¹"An Introduction to MATLAB: Introduction" http://cnx.org/content/m21391/latest/