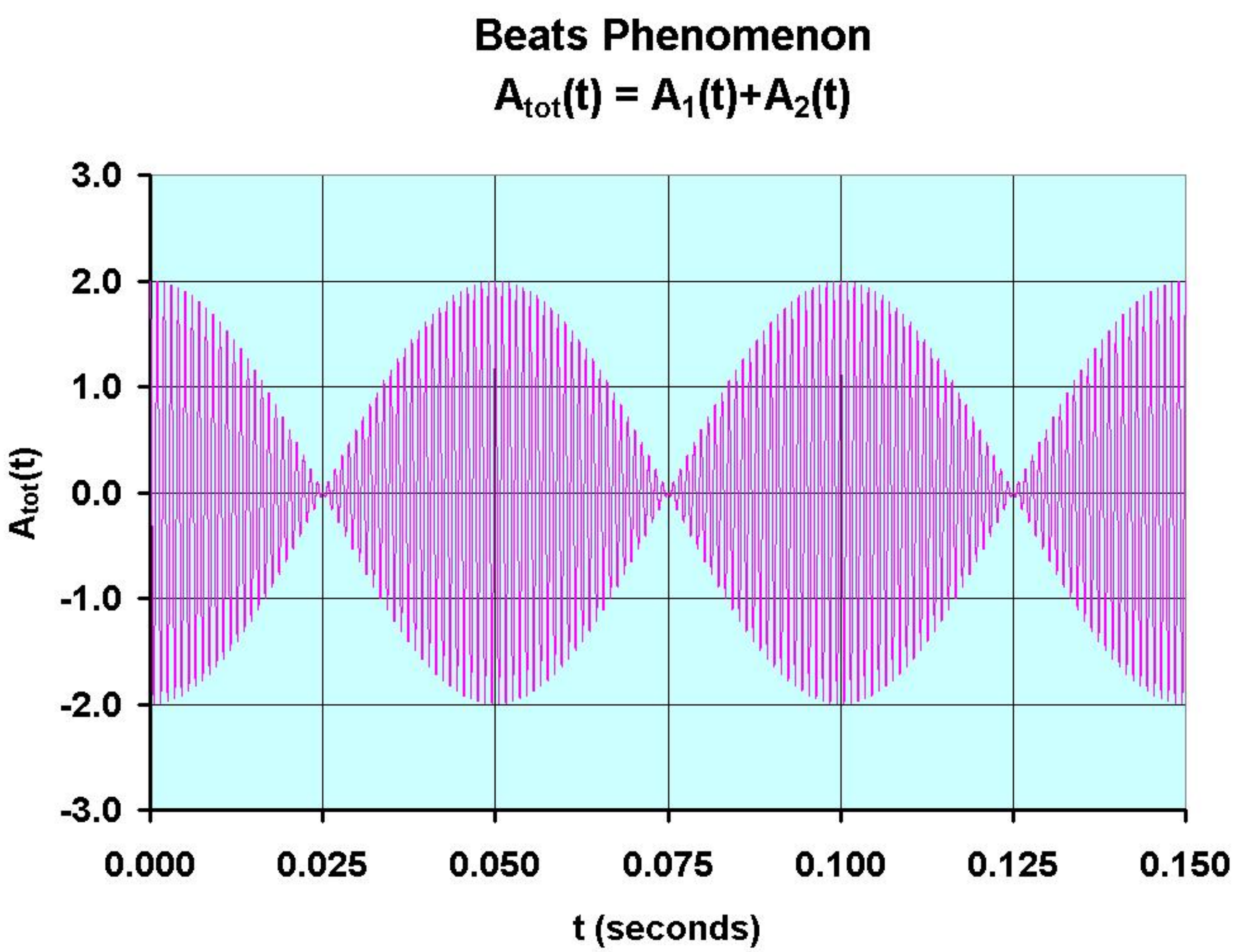
The phase of the total amplitude, $A_{tot}(t)$ relative to that of the first amplitude $A_1(t)$, at an arbitrary time, t is $\Delta\psi(t)$ and is obtained from the projections of the total amplitude phasor, $A_{tot}(t)$ onto the y- and x- axes of the 2-D phasor plane:

$$Tan\psi = \frac{A_2(t)Cos(\omega_2(t)t + \Delta\varphi_{21}(t))Sin\Delta\varphi_{21}(t)}{A_1(t)Cos(\omega_1(t)t) + A_2(t)Cos(\omega_2(t)t + \Delta\varphi_{21}(t))Cos\Delta\varphi_{21}(t)}$$

The total amplitude, $A_{tot}(t) = A_1(t) + A_2(t)$ vs. time, t is shown in the figure below, for time-independent/constant frequencies of $f_1 = 1000$ Hz and $f_2 = 980$ Hz, equal amplitudes of unit strength, $A_{10} = A_{20} = 1.0$ and zero relative phase, $\Delta\varphi_{21} = 0.0$



Clearly, the beats phenomenon can be seen in the above waveform of total amplitude, $A_{tot}(t) = A_1(t) + A_2(t)$ vs. time, t. From the above graph, it is obvious that the beat period, $\tau_{beat} = 1/f_{beat} = 0.050$ sec = $1/20^{th}$ sec, corresponding to a beat frequency, $f_{beat} = 1/\tau_{beat} = 20$ Hz, which is simply the frequency difference, $f_{beat} \equiv | f_1 - f_2|$ between $f_1 = 1000$ Hz and $f_2 = 980$ Hz. Thus, the beat period, $\tau_{beat} = 1/f_{beat} = 1/| f_1 - f_2|$. When $f_1 = f_2$, the beat period becomes infinitely long, and no beats are heard.