

**Example 3-12:** Suppose we want to synthesize a frequency sweep from  $f_1 = 300$  Hz to  $f_2 = 800$  Hz over a 0.5 second time interval, where the beginning and ending times are  $t = 0$  and  $t = T_2 = 0.5$  s as in Fig. ???. First of all, it is necessary to create a formula for the desired instantaneous frequency

$$f_i(t) = \frac{f_2 - f_1}{T_2} t + f_1 = \frac{800 - 300}{0.5} t + 300$$

which is the sloping line in Fig. ???. Then we must integrate  $\omega_i(t) = 2\pi f_i(t)$  to get the angle function:

$$\begin{aligned}\psi(t) &= \int_0^t 2\pi f_i(u) du \\ &= \int_0^t 2\pi (1000u + 300) du \\ &= 1000\pi t^2 + 600\pi t + \varphi\end{aligned}$$

where the phase,  $\varphi = \psi(0)$ , is an arbitrary constant of integration. The time-domain chirp signal corresponding to Fig. ?? is  $x(t) = \cos(1000\pi t^2 + 600\pi t + \varphi)$ .

