1.5.4 Find and plot the current $i(t)$ in the circuit if $v(t) = 10\cos(120\pi t)$. *Note: Diagram not shown.*

First, we write the impedance around the loop.

$$\begin{aligned} Z &= R + j\omega L + \frac{1}{j\omega C} \\ &= 10 + j120\pi \cdot 0.1 + \frac{1}{j120\pi \cdot 0.001} \\ &= 10 + j12\pi - j\frac{1}{0.12\pi} \\ &= 10 + j\left(12\pi - \frac{1}{0.12\pi}\right) \end{aligned}$$

Now we can use Ohm's law to find the current around the loop.

$$\begin{aligned} I(\chi) &= \frac{V(\chi)}{Z} \\ &= \frac{10e^{j0}}{10 + j(12\pi - \frac{1}{0.12\pi})} \\ &\approx 0.0753 - j0.264 \end{aligned}$$

$$\begin{aligned} i(t) &= \sqrt{(0.0753)^2 + (-0.264)^2}\cos\left(120\pi t + \tan^{-1}\left(\frac{-0.264}{0.0753}\right)\right) \\ &= 0.275\cos(120\pi t - 1.293) \\ &= 0.275\cos(120\pi t - 74^\circ)\text{A} \end{aligned}$$