LC Time Interpretation

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This problem is borrowed from Chapter 30 of the *Student Workbook* for *Physics for Scientists and Engineers.*

Activity

The capacitor in an LC circuit has maximum charge at $t = 1$ µs. The current through the inductor next reaches a maximum at $t = 3$ µs.

(a) When will the inductor current reach a maximum in the opposite direction?

The current in an LC circuit oscillates as $I = I_{max}\sin(\omega t + \phi)$, where ϕ is some phase constant. The charge on the capacitor is maximum when the current is zero, so the two events are 90° out of phase. That means the time between the two is a quarter of the circuit's period:

$$\Delta t = 2 \text{ µs} = \frac{T}{4}.$$

The inductor current changes direction after a 180° phase change, so we need to add half of the period ($T/2 = 4$ µs) to the time of the first maximum ($t = 3$ µs) to reach the inverted maximum. That gives us the desired time of $t = 7$ µs.

(b) What is the circuit's period of oscillation?

As we said before, $\Delta t = \frac{T}{4}$, so $T = 8$ µs.