Basic Electronics Part 24
by
Thomas Atchison W5TV

As we considered in Part 23, we will continue to look at a simple circuit with a single inductor as in Fig. 1

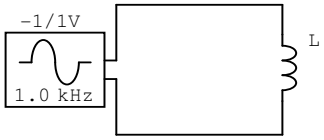

Fig. 1

You see there is an applied voltage across the inductor that forces a current through it. This applied voltage is not in phase with the current through the inductor. Suppose the applied voltage starts with a positive peak at 0 degrees. The current begins to flow rapidly through the inductor. As the applied voltage decreases to 0, the current through the inductor peaks. The applied voltage now increases in the negative direction and the current decreases to zero when the applied voltage is at a negative peak. The current begins to flow rapidly in the opposite direction until it reaches a peak. That peak occurs when the applied voltage is back to zero. Then the applied voltage increases in the positive direction to a peak value, causing the current to decrease to zero and the process begins again. See Fig. 2

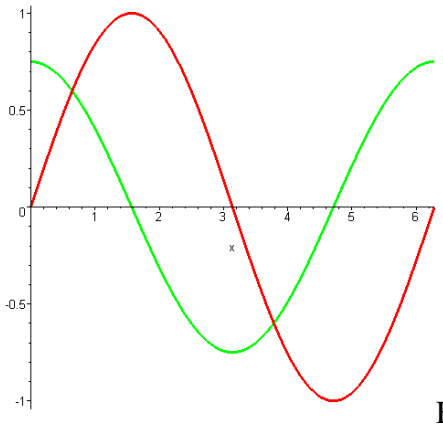

Fig. 2

Here the green curve represents applied voltage across the inductor and the red curve represents current through the inductor. The applied voltage leads the current by 90 degrees.

Now consider our discussion in Part 23 concerning current through an inductor and induced voltage. There the current leads the induced voltage by 90 degrees. Putting these together we see that the applied voltage and the induced voltage are 180 degrees out of phase. The induced voltage is sometimes called the back electromotive force (EMF). See Fig. 3

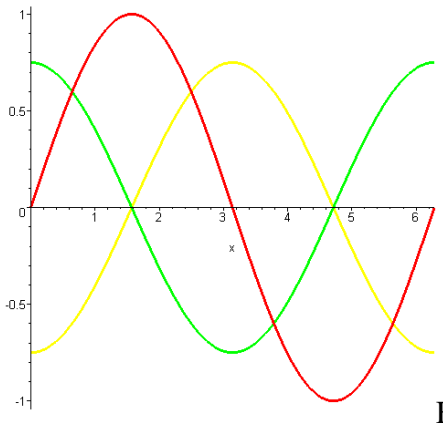

Fig. 3

Here the added yellow curve is the induced voltage or back EMF. Notice that the applied voltage (green) and the induced voltage (yellow) are 180 degrees out of phase. The applied voltage tries to produce current through the inductor and the induced voltage tries to prevent it.

In the next discussion we will see what happens when we include both an inductor and a capacitor in series with an alternating voltage source.