DRIVEN LC CIRCUIT

RESONANCE IN AN LC CIRCUIT IS DEMONSTRATED. MUTUAL INDUCTANCE IS QUALITATIVELY DEMONSTRATED.

THIS DEMONSTRAION HAS TWO ESSENTIALLY INDEPENDENT CIRCUITS. THE ONLY COMMON CONNECTION IS THE GROUND IN THE SCOPE. THE CIRCUITS OF COURSE INTERACT VIA THE MUTUAL INDUCTANCE.

EQUIPMENT:
- TEK 465 OSCILLOSCOPE
- HP 3310A FUNCTION GENERATOR
- SET OF TWO WHITE STAND-UP COILS (L5)
- 1 2500 PICOFARAD CAP.
- 3 BANANA-TO-BNC CONNECTORS
- CABLES

SET UP:
WIRE AS IN SKETCH. SYNC OUTPUT FROM 3310A GOES TO EXTERNAL TRIGGER OF SCOPE. COIL FACES SHOULD BE TOUCHING.

SCOPE: USE EXTERNAL TRIGGER MODE
3310A:
- Use low output
- Set range (really a multiplier) to 10kHz
- Adjust output level to give about 0.5 volts on CH 1
- Set frequency dial to 20 (this gives initial frequency of 20 x 10 kHz = 200 kHz)

Resonance is at about 75kHz (dial at 7.6, range at 10kHz) with coils touching. If the coils are separated by about 2 inches the resonant frequency falls to 68kHz.

Figures 1-6 show passage through resonance with the coils touching. Figures 7 & 8 are with a two inch gap between the coils.

\[
\omega = \frac{1}{\sqrt{LC}}\\
\omega = \frac{2\pi}{\sqrt{LC}}\\
f = \frac{1}{2\pi\sqrt{LC}}
\]

\(f_w \approx 40 \text{kHz}\)
Calculate Resonant Frequency $f$

$$f= \frac{1}{2\pi \sqrt{LC}}$$

where $L = 81.5 \text{ mH}$
and $C = 2500 \text{ pF}$

$$f= \frac{1}{2\pi \sqrt{(81.5 \times 10^{-3} \text{ H})(2500 \times 10^{-12} \text{ F})}}$$

$f = 11.15 \text{ kHZ}$
X79. LC Circuit Driven through Mutual Inductance of 2 Coils; CRT -10M

Purpose: Illustrate LC resonance driven through the mutual inductance of 2 coils.

Equipment: Two white-stand coils; audio oscillator, capacitance in secondary.

Procedure:
- Drive one coil with audio oscillator.
- The other has a capacitor so it is an LC Circuit driven through mutual inductance.
- Output of LC circuit goes to scope; internal trigger I think.
- Change frequency to find resonance ($\omega = (1/LC)^{1/2}$)
- Scope goes crazy when hits resonance.
- Vary spacing of coils: changes mutual inductance and resonant freq. (not derived).
- Demonstrates resonance in an LC circuit and also mutual inductance.
- Did not note values of $L$, $C$, $\omega$. (Lecture setup notes should have them.)

Ref: wl video V42; tape 3:14:08

![Diagram of LC circuit driven through mutual inductance]
PASSING THROUGH RESONANCE - COILS TOUCHING

CH 1
200 KHz
20 ms/div
Fig. 1

CH 2

CH 1
90 KHz
Fig. 3

CH 12

CH 2

CH 1
50 KHz
Fig. 5

CH 2

CH 1
10 KHz
Fig. 6
Coils 2" Separated.
L4

\[ f = \frac{1}{2\pi \sqrt{LC}} \]

2500 pf