

Lab 04

MAGNETICALLY COUPLED CIRCUITS

Goal: To study the electric signal transmission between two resonance circuits coupled magnetically.

Experiment

1. Two resonance circuits magnetically coupled.

1.1 Build the circuit of Fig. 1.

1.2 Measure capacitor voltages U_{C1} and U_{C2} as a function of frequency of the constant current in the primary circuit. The constancy of this current should be maintained by keeping the generator output voltage U_G constant and using sufficiently large impedance Z in series with the powered circuit. This allows to replace the total impedance by the impedance Z and get the constant current as:

$$i = U_G/Z$$

The measurements should be performed for: i) over-critical coupling, ii) critical coupling and iii) weak, below critical, coupling.

2. Resonance and damped circuits.

2.1 Build the circuit of Fig. 2.

2.2 Measure capacitor voltages U_{C1} as a function of frequency of the constant current in the primary circuit. Measurements should be performed for three different values of the impedance R_z ; about 10Ω , 100Ω and one much larger value.

3. Background

3.1 Inductance, capacitance and resistance in AC circuits.

3.2 Electrical resonance circuits (series, parallel). Magnetic coupling.

3.3 Coupled circuits and transmission of electrical signals.

Pre-lab reading

[1] I. Mayergoyz, W. Lawson, *Basic Electric Circuit Theory*.

[2] W.H. Hayt, *Engineering Circuit Analysis*.

[3] W.H. Hayt, J.E. Kemmerly, *Engineering Circuit Analysis*.

[4] S. Szczeniowski *Fizyka. Tom III. (Elektryczność i magnetyzm)*.

[5] T. Szczypułowski *Podstawy elektroniki*.

[6] I.P. Żerebcow *Radiotechnika*.

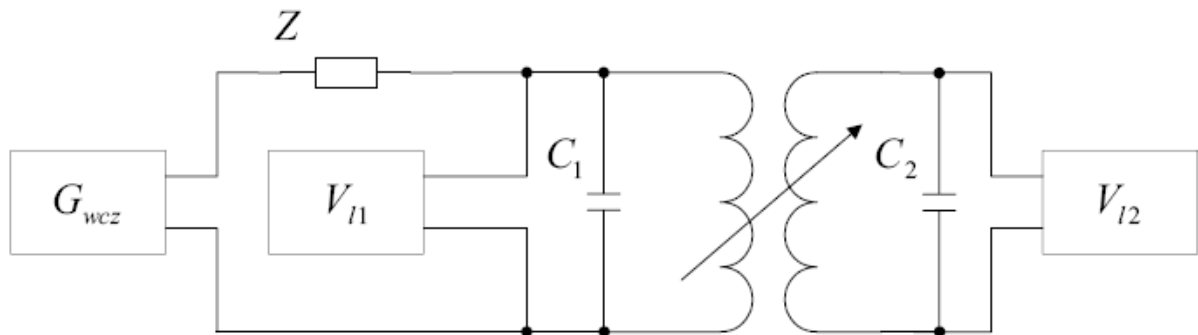


Fig 1: Magnetically coupled resonance circuits with HF generator and voltmeters.

G_{wcz} – High frequency generator,

V_{11} and V_{12} – high frequency voltmeters (bulb voltmeters).

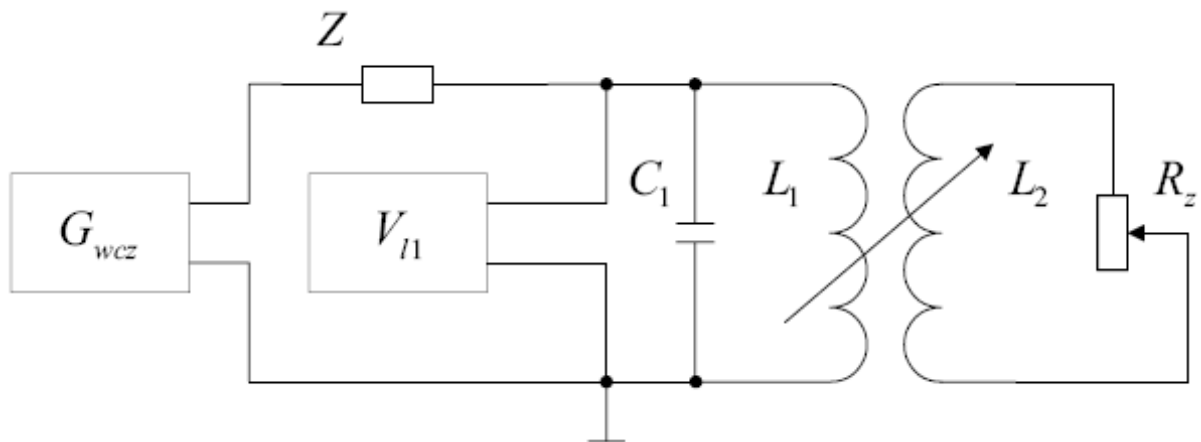


Fig 2: Magnetically coupled resonance circuit magnetically coupled to damped circuit with HF generator and voltmeter.

G_{wcz} – High frequency generator,

V_{11} – high frequency voltmeter (bulb voltmeter).