RLC Circuit

Related topics

Tuned circuit, series-tuned circuit, parallel-tuned circuit, resistance, capacitance, inductance, capacitor, coil, phase displacement, Q-factor, band-width, loss resistance, damping.

Principle and task

The current and voltage of parallel and series-tuned circuits are investigated as a function of frequency. Q-factor and band-width are determined.

Equipment

Function generator	13652.93	1
Digital counter, 4 decades	13600.93	1
Coil, 300 turns	06513.01	1
Connection box	06030.23	1
Resistor in plug-in box 200 Ohms	06057.20	1
Multirange meter with amplifier	07034.00	1
PEK carbon resistor 1 W 5% 10 Ohm	39104.01	1
PEK carbon resistor 1 W 5% 1 kOhm	39104.19	2
PEK capacitor/case 2/1 mmF/ 400 V	39113.01	1
PEK capacitor/case 1/0.1 mmF/ 500 V	39105.18	1
Connecting cord, 250 mm, red	07360.01	2
Connecting cord, 250 mm, blue	07360.04	2
Connecting cord, 500 mm, red	07361.01	3
Connecting cord, 500 mm, blue	07361.04	3

Problems

Determination of the frequency performance of a

1. Series-tuned circuit for
   a) voltage resonance without damping resistor,
   b) current resonance without damping resistor,
   c) current resonance with damping resistor.

2. parallel-tuned circuit for
   a) current resonance without parallel resistor,
   b) voltage resonance without parallel resistor
   c) voltage resonance with parallel resistor.

Set-up and procedure

The experimental set up is as shown in Fig. 1.

- Function generator:
  – DC-offset: ± 0 (multimeter in DC-mode)
  – Amplitude: 3 to 4 V (multimeter in AC-mode)
  Frequency: 10^3 Hz
  Mode: ~

- Digital counter: kHz/Frequency mode

Fig.1: Experimental set up for investigating tuned circuits.

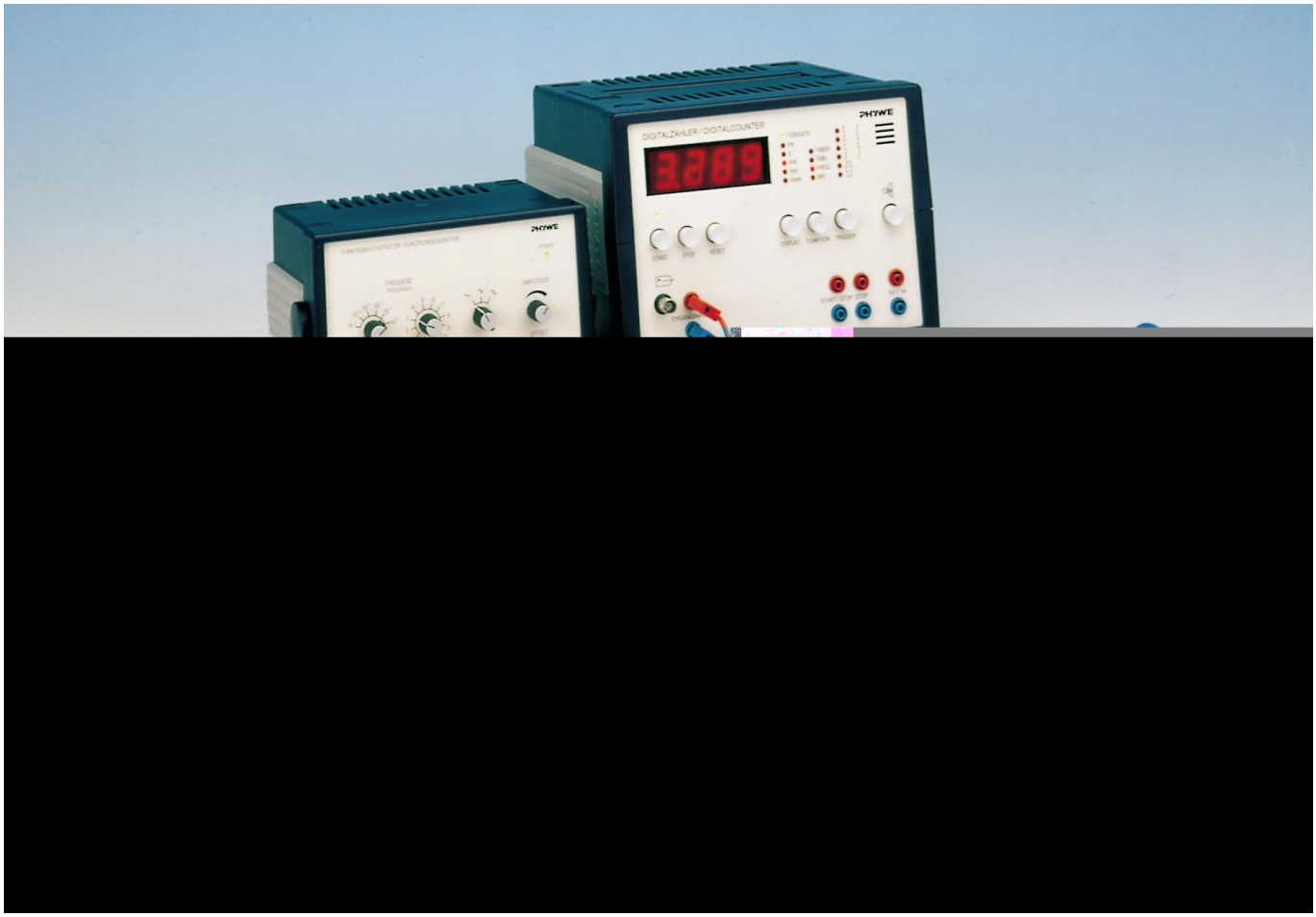


Fig. 6: Voltage as a function of the frequency with the parallel-tuned circuit.
1: $R_d = \infty$
2: $R_d = 1\ \mathrm{k\Omega}$
3: $R_d = 0.5\ \mathrm{k\Omega}$

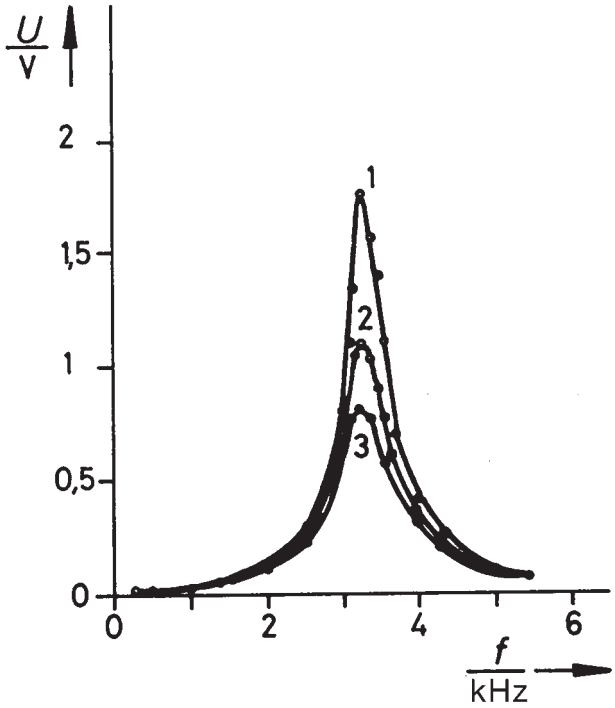
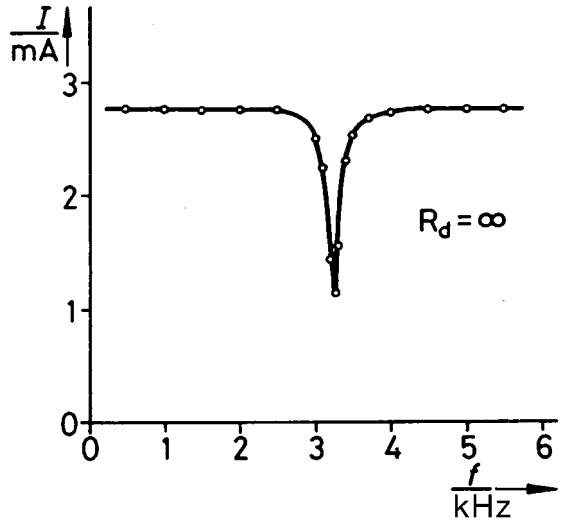


Fig. 7: Current as a function of frequency with the parallel-tuned circuit.



The Q-factor from Fig. 6, in accordance with (6), is

1: $Q = 13.0$

2: $Q = 5.77$

3: $Q = 7.53$

This agrees with the Q-factor calculated according to (5) to within nearly 4 %. If the voltage U is considered as the terminal voltage of an equivalent source of internal resistance $R + R_t$, the current flowing into the tuned circuit is

$$I = \frac{U}{R + R_t} .$$