Task 9: Ferroresonance Phenomena Measurement

(Laboratory F1-116)

In the circuit with a nonlinear inductance observe and record transition to the ferroresonance state. Perform the following measurements:

a) Determine current and voltage on inductance during the transition to the ferroresonance state for capacity $C = 4$ µF.

b) From measured data plot the dependency of magnetic flux on current **φ = f(i)**.

c) Measure dependencies of **V_2=f (V_1)** during the transition to the ferroresonance state for two capacitances $C = 4$ and 40 µF for both increasing and decreasing voltage V_1.

      V_1 is voltage on the output of the control transformer;

      V_2 is high voltage on the 6 kV side of instrument voltage transformer (IVT).

      Dependencies should be measured for three values of resistivity R_2 (for $C = 4$ µF: 100, 50 and 5 Ω; for $C = 40$ µF: 100, 70 and 35 Ω).

Used equipment:

U_{reg}	control transformer 0 - 250 V
IVT	instrument voltage transformer 6 kV/100 V
A	ammeter up to 20 A
V	voltmeter up to 260 V
kV	electrostatic kilo-voltmeter up to 30 kV
R_1, R_2	sensing and load resistors
C	capacitor 4 or 40 µF

Digital oscilloscope

Differential probe

Measurement circuit:
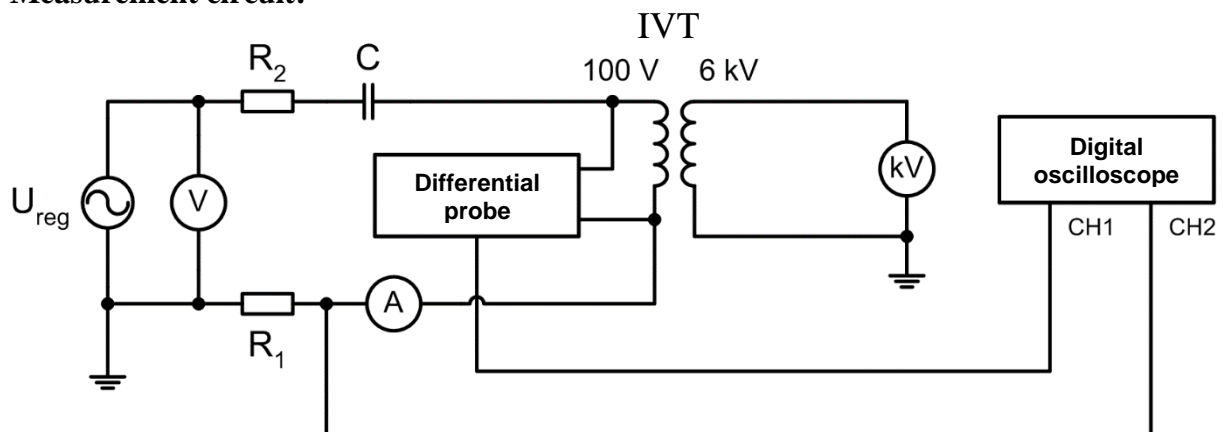
Evaluation of the measurement:

Ad b)

The recorded time dependency of inducted voltage $u_i(t)$ has to be processed by numerical integration (e.g. in software Matlab, Mathematica, Excel, …).

The time dependency of magnetic flux $\varphi(t)$ on instrument voltage transformer (IVT) is calculated by numerical integration of $u_i(t)$. The final plot of $\varphi = f(i)$ can be then created.

Ad c)

The dependency $V_2 = f(V_1)$ has a different shape in the case when the voltage is decreasing and in the case when the voltage is increasing (hysteresis dependency – i.e. the state of a system depends on previous state). From this reason it is important to keep the same direction of voltage control during both phases of measurement. In the first phase the voltage is increased up to maximum value $1.5\ U_{1n}$ (on 100 V side of instrument voltage transformer) and in the second phase the voltage is decreased back to zero value. More measured points should be recorded in the area where the system goes to the ferroresonance state.