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The Stand for Determination of Service Performance in Load of a Welding Transformer Using the LabVIEW Environment

This paper presents the way of performance's characteristics determination in load of welding transformers` performance parameters using the data acquisition systems through virtual tools. Nowadays observing the parameters of welding service and of welding instruments` characteristics means an important step regarding the quality of weld throat.

Keywords: *transformer, start under load, welding, data acquisition*

1. The assembly for determining the characteristics of the welding transformer

Experimental assembly for determining the characteristics of the transformer shown in Figure 1 and the following components:

- Ammeter with field 10A;

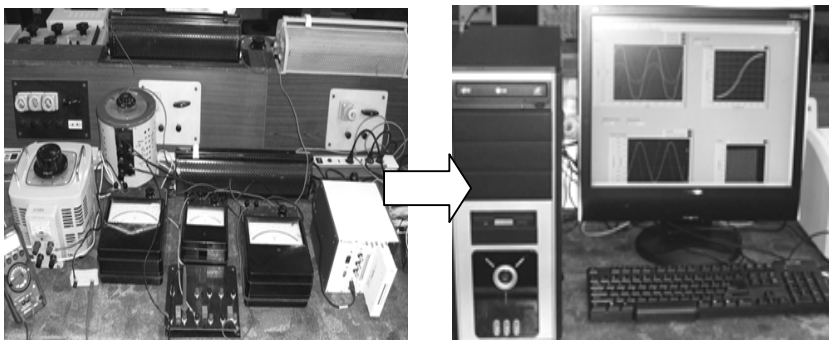

Figure 1. Experimental assembly for lifting characteristics transformer

- 300V voltmeter V range, are instruments of measurement standards used to verify the accuracy of the transducer and the current values obtained using CT;
- CT, current transducer that we used to purchase the current in primary winding of the transformer; it transforms electric current into a voltage to be supported by the data acquisition system;
- AT autotransformer used to get a different actual voltage values;
- Transformer, for determining characteristics.

To acquire voltage and current we used SCXI 1125 module, which is a signal-conditioning module with eight isolated channels, programmable, with which were acquired and digitized signals over the SCXI 1600 module.

2. The mathematic model of welding transformer performance under load

The activity service under load characteristic is that while the primary envelopment is connected to a constant tension source $U_1 = U_{1n}$, to the side terminals is connected a finite impedance not equal to zero. This service`s conditions are that is necessary to know the transformer`s behaviour when the side terminals` load is modified.

To observe the performance of monophase`s transformer in load we can use the adapted scheme, which can be obtained by not taking into account the current I_{01}. This current represents only some percents of the I_{1n} current.

From the vector diagram represented in the Figure 2 we can obtain:

$$\begin{aligned} \underline{U_1} &= \underline{I_1 Z_1} - \underline{U_{e1}} \\ \underline{U'_2} &= -\underline{I'_2 Z'_2} + \underline{U_{e1}} \\ \underline{I_{01}} &= \underline{I_1} + \underline{I'_2} \\ \underline{U_{e1}} &= -\underline{Z_{1m} I_{01}} \\ \underline{U'_2} &= \underline{I'_2} \cdot \underline{Z'} \end{aligned} \qquad (1)$$

With these notations relations (1) becomes:

$$\underline{I_1} = -\underline{I'_2}; \quad \underline{U_1} = (\underline{Z_1} + \underline{Z'_2})\underline{I_1} - \underline{U'_2}. \qquad (2)$$

The quotation is:

$$\underline{U''_2} = -\underline{U'_2}, \qquad (3)$$

And the quotation (1) becomes:

$$\underline{U_1} = \underline{Z_{1sc} I_1} + \underline{U''_2} = \underline{U_{1sc}} + \underline{U''_2}. \quad (4)$$

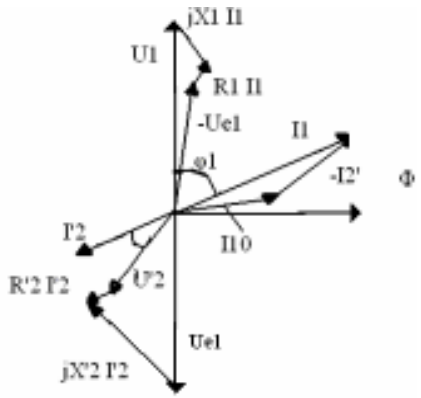

Figure 2 The transformer`s vector diagram

3. Data aquisition

The application part of the paper wants to present the aquisition of more signals from a welding transformer using the LabVIEW programme environment.

The signals` aquisition and adaptation is made by using the SCXI module, a programmable system of high performance singnals` conditioning, made for applicatin which needs a high number of aquisition channels. These channels can be used in the industrial environment.

After configuring the application and channels, the acquisition can start. The purchased sizes can be read, can be analysed the obtained data and show the proper results for the current application.

In the first phase we checked the transducer's precision for lower values of primary tension, primary current, secondary tension. In the second phase, we checked the transducer's performance for higher values of primary tension, primary current, secondary tension.

The results presented in the Figure 2 and Figure 3.

Of the two running tests we found that the high values of primary voltage, the current deforms. At the lower values, the current is perfectly sinusoidal shape, the primary voltage is dephased with 180° until the primary current, and the secondary one with 180° after the current, taking as the origin of the primary beam current by voltage.

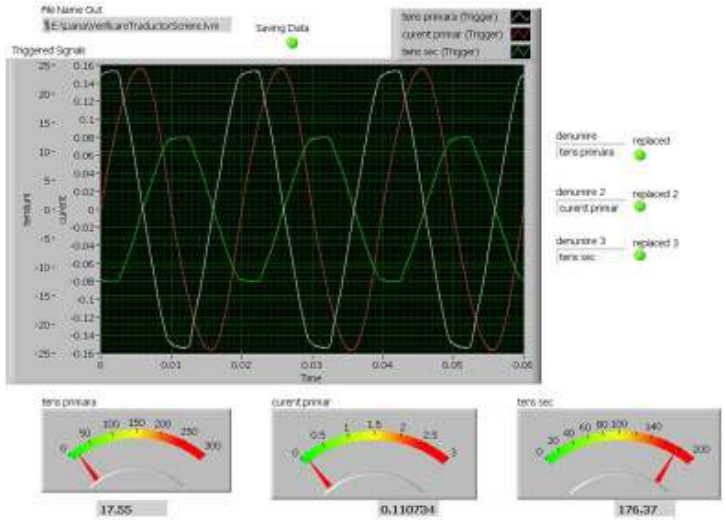

Figure 2. Frontal panel of a virtual instrument for checking transducer operation, for low current

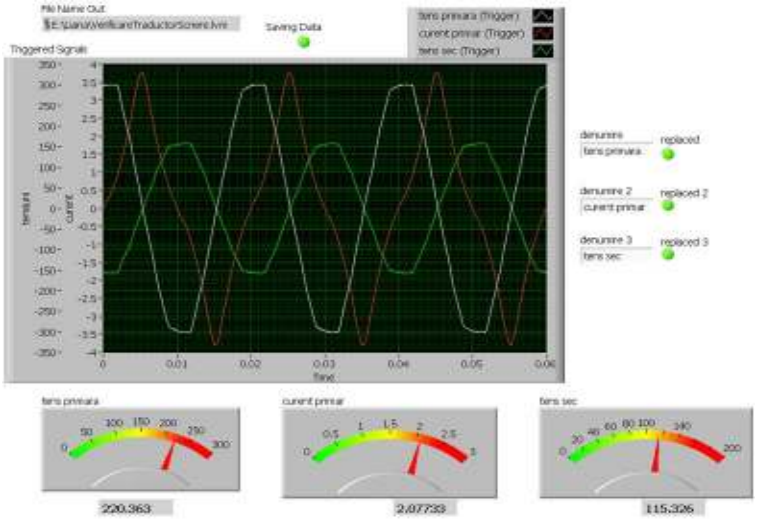

Figure 3. Frontal panel of a virtual instrument for checking transducer operation, for high current

In the following phase it is presented the block diagram of the virtual instrument used to realise a time evolution check of the primary current.

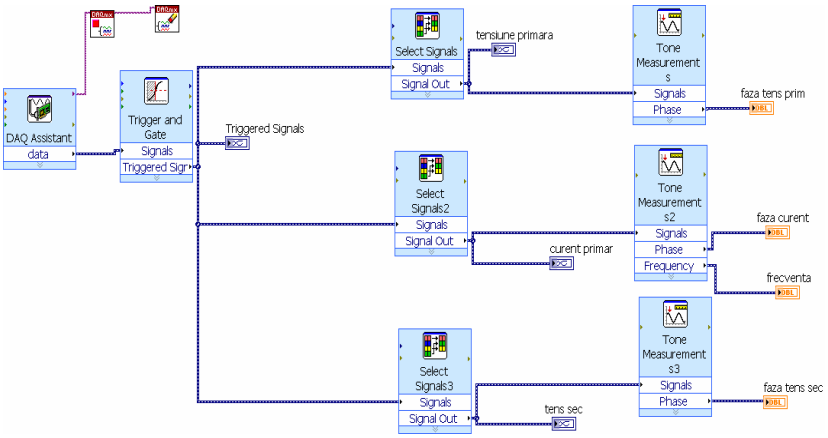

Figure 4. The block diagram of the virtual instrument which represents the wave form of the primary current

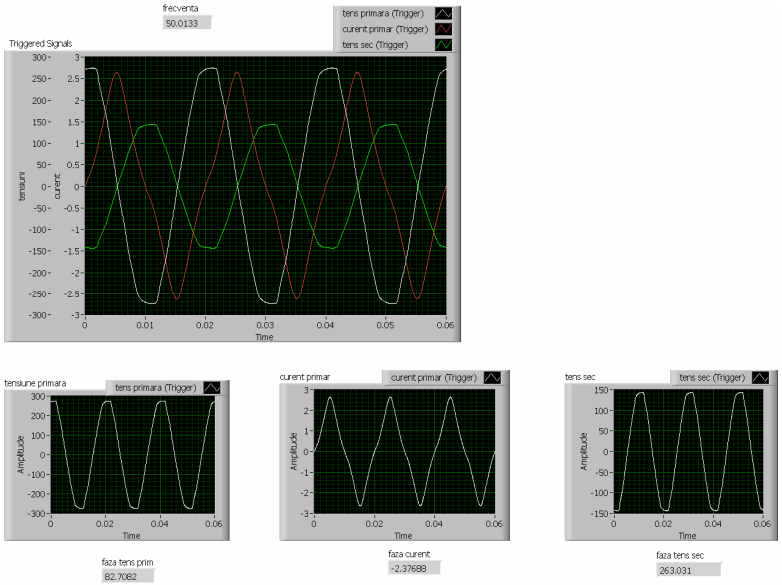

Figure 5. Frontal pannel of a virtual instrument which represents wave form of the primary current

After running the program we can observe that the secondary voltage is dephased with 180° before the primary current, and the second voltage is

dephased with 180° after the current, taking as the phase origin the current as a primary voltage function.
In the block diagram of the virtual instrument from the Figure 6 we presented the virtual instrument to determine the spectral analyse of the primary current, the harmonics` content.

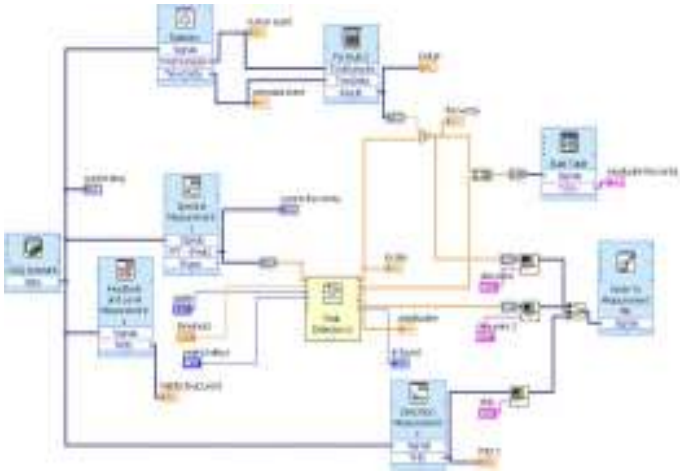

Figure 6. The block diagram of the virtual instrument for spectral analyse of the primary current

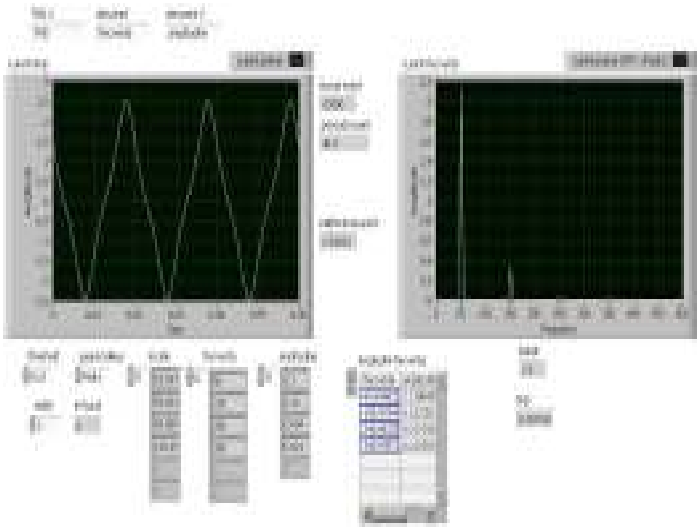

Figure 7 The frontal pannel of a virtual instrument for spectral analyse of low values of primary current

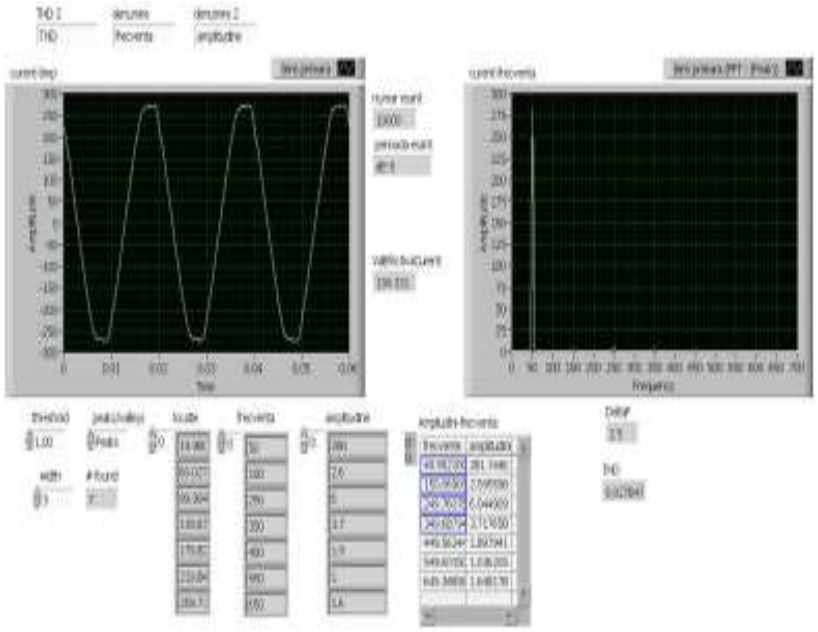

Figure 8. The frontal pannel of a virtual instrument for spectral analyse of high values of the primary current

In Table 1 are recorded the measurements` values of the transformer at performing under load

Table 1

No	Primary current	Primary real output	Secondary voltage	Secondary real output	Secondary current
1	44.136002	31.818926	22.525642	0.710616	1.825373
2	1.851932	79.110813	30.872886	55.131521	1.789004
3	1.881096	95.757229	30.635584	70.356631	2.300000
4	1.904604	119.156825	30.252634	91.405513	3.024865
5	1.926267	132.447666	30.098891	103.480695	3.441228
6	1.976457	157.519760	29.909916	125.812418	4.209442
7	2.010539	173.346707	29.771040	139.668478	4.694338
8	2.318565	293.174172	28.562897	240.766846	8.431929
9	3.109196	504.943254	26.690574	399.238005	14.960887
10	39.995707	-8.528174	0.024291	-0.428437	40.013494

3. Conclusion

The accuracy of measurements made using the system SCXI can be disturbed by noises, disturbances which appear when the connections between the signal source and the module are not protected when they are running.
After running the two tests we observed that the large amounts of current frequency, current is disturbed, and after applying the Fourier transform appears only the basic armonic of first degree, while when in low currents appear more armonics of 1, 3, 5 degree because the transformer has odd armonics number.

References

[1] Alimpie I., Stoiciu D. *Măsurari electronice, senzori şi traductoare*, Editura Politehnica, Timişoara, 2007.

[2] Tătucu, I., Gruescu, L. – *Method and apparatus for measuring the difference of a slops of the welding current* – Annals of the Faculty of Engineering Hunedoara, vol. II, an I, fascicle 2, ISSN 1454-6531, 2000.

[3] Tatucu, I., Suciu, L, *Numerical model for the study of electromagnetic processes in non stationary regime.* Eftimie Murgu University Resita Annals, ISSN 1453-7394, 2006.

[4] Tătucu I., Nicoleta Gillich N.– *Electrotehnică*, Editura Eftimie Murgu, Reşiţa, 2001.

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