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POWER MEASUREMENTS with LabVIEW

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ABSTRACT

The paper presents a data acquisition system which consists in Hall effect sensors, a PCI 6023(National Instruments) data acquisition board, LabVIEW graphical programming environment and the experimental results achieved by the authors concerning the behavior of a.c. electrical circuits. The appearance of the LabVIEW environment was motivated by the research automation activity and by the application development, based on a hierarchical instrument structure, which is composed by the user's interface and the visual programming elements.

1. INTRODUCTION

The use of the LabVIEW graphical programming environment ensures the analysis and study of power measurement methods in single-phase and three-phase alternative current circuits [2,5]. The evolution in both electric measurement technique, in the electronic field and in the area of data acquisition systems, arguments the opportunity and justification of designing new instruments in order to improve the research activity in this area[3,4].

2. POWER MEASUREMENT in SINGLE-PHASE AC CIRCUITS

The complex apparent power (S) is defined into the simplified complex representation as the product between the complex voltage (U) and the conjugate complex current (I*):

$$\underline{S} = \underline{UI}^* = UI\cos\varphi + jUI\sin\varphi = P + jQ \qquad (1)$$

By taking into account the relations above, we can notice that $S^2 \neq P^2 + Q^2$ and therefore the notion of *deforming power* can be introduced:

$$D^2 = S^2 - P^2 - Q^2 \qquad (2)$$

The application below (fig. 1) which is realized by using the LabVIEW graphical programming environment, basing on the presented theoretical considerations [4,5], allows the graphical display of the time variation of the voltage, the current, the instantaneous and active power. Control elements are used in order to modify the voltage and the charge impedance parameters, and also other elements are used for indicating the voltage, the current, the power factor, the active, reactive and apparent power. The acquisition data board is a complex system which allows parameter measurement and monitoring from a technological process, using transducers which can transform studied physical measures into electrical voltage [1,2,3,4,5]. For a single-phase ac circuits, it is necessary to obtain signals with voltage-range amplitude, to be applied at the input of the board. The adopted solution was to use current and voltage transducers based on the Hall effect.

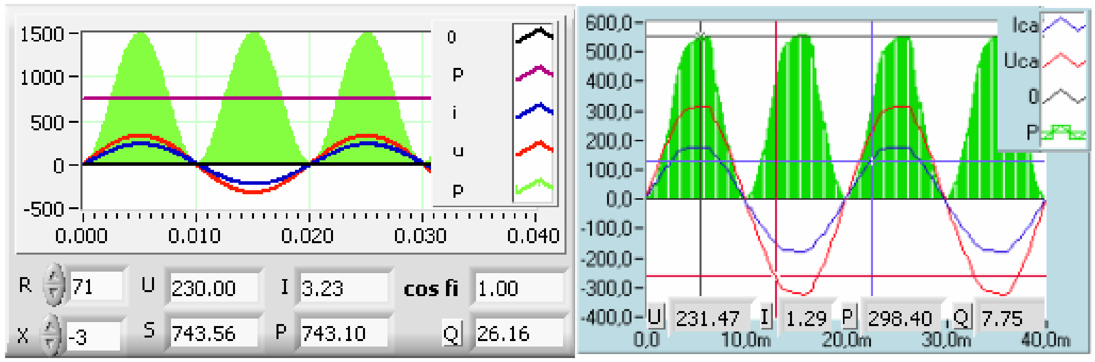
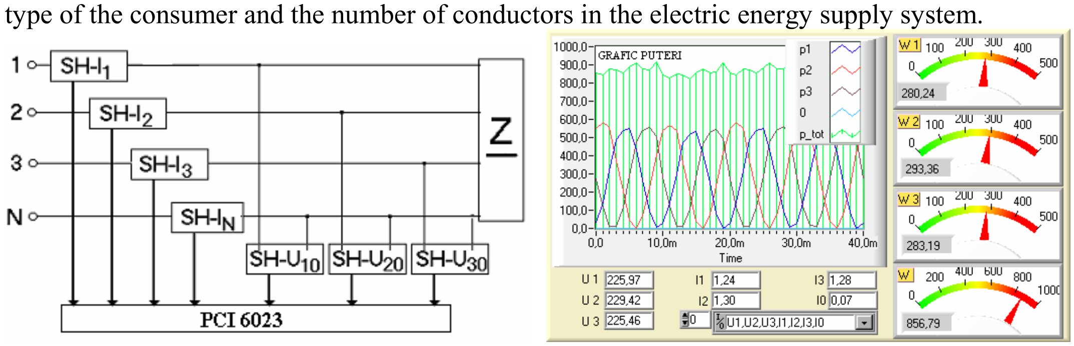


Fig.1. Single-Phase AC Circuits Operation and Power Measurement:
a) – simulation; b) experimental results

3. POWER MEASUREMENT in THREE-PHASE AC CIRCUITS

The measuring methods for active/reactive power in three-phase ac circuits, depend on the type of the consumer and the number of conductors in the electric energy supply system.



SH – $I_1/I_2/I_3$ – *LA55-P*; **SH – I_N** – *LA 25NP*; **SH – $U_{10}/U_{20}/U_{30}$** – *LV25-P*

Fig.2. Data Acquisition System – block diagram and experimental results

4.CONCLUSION

These applications can be used both for studying the measurement methods of power (student/personnel training because of the ability of modifying the parameters of the circuits and of the effect display) and for performing high accuracy measurements. The use of the presented signal conditioning system enlarges the data acquisition abilities in the electric system, in order to study the operation of electric machines, converters, transient rates. The flexibility of the instrument is given by the possibility of including other operations in the measurement process (analysis, operation automation, access to the data basis, sending data on the Internet, etc.).

5. REFERENCES

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