The submerged arc furnace state of work in the frequency domain

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Abstract **This article describes the method of the measure of voltages and currents on electrodes of the submerged arc furnaces. The asymmetrical and the symmetrical state of the work have been shown in the frequency domain. The results of the measures have been illustrated and interpreted.**

Keywords **submerged arc furnace, electric arc parameters, nonlinear systems, measurements.**

I. INTRODUCTION

The ferrosilicon smelting process in the submerged arc furnaces (SAF) belongs to the high energy consuming processes. Careening for the energy efficiency is the matter of priority. Saving a few percentage brings measurable economic and environment benefits. An appropriate smelting control, a measurement, an acquisition and a data processing have influence on it [1].

II. THE MEASUREMENT SYSTEM

Electrical parameters of the SAF are monitored and recorded in the measurement system (fig. 1)in the furnace hall. Parameters of the electric system of primary side of the autotransformer and also voltage and current of electrodes are required for the proper control of the furnace.

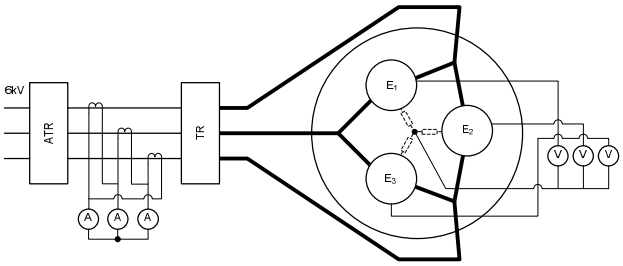

Fig. 1. A schematic diagram of a submerged arc furnace with simplified measured systems

Phase voltages of the SAF have been measured in the installed measurement system, directly on the electrode columns [2]. The electrode currents have been determined basing on the currents of current transformers in the primary side of the furnace transformer by multiplying the measured values by the transformer winding turns ratio.

III. MEASUREMENTS AND THEIR INTERPRETATION

Measurements have been made in the one-minute intervals with the sampling frequency equalling 32kHz. During the measurement of the SAF the transition from the asymmetric state into the symmetric state of the furnace have been recorded. From the carried out measurements result that the voltage on electrodes are distorted in both cases. The exemplary spectrum of the voltages harmonics during the asymmetric state has been shown in the figs. 2 [3], [4].

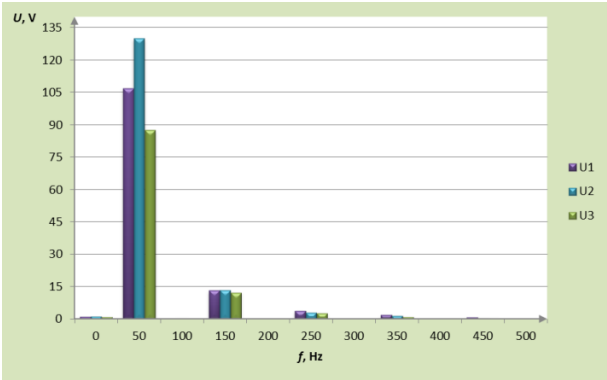

Fig. 2. The harmonic spectrum of the electrode voltages during the asymmetric state

IV. CONCLUSION

The very well knowledge of the process conducting is required from the managing staff and also from the operator. They should respond to the detuning of an optimal parameters of the process due to imprecise control algorithm, emergency conditions, periodically drain the liquid product and the dosing of the components, which parameters depend on the supplier (humidity, granulation). All of the listed above terms have influence on the maintenance of the stable working point. It is possible to control the process in such a way that the working point is placed close to the optimum.

V. REFERENCES

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