

## Section 01. Innovations in Engineering

Dmytro Halushko, David Reznytskyi

V.V. Kuznetsov, research supervisor

I.P. Nikitina, language adviser

National Metallurgical Academy of Ukraine, Dnipro

**Energy Saving Algorithm for Calculating the Commercial Electric Network**

**Introduction.** The presence of low-quality electric power in the shop networks of industrial enterprises leads to accelerated physical aging of the equipment used and an increase in the risk of accidents at work. Timely evaluation of electricity quality indicators and maintenance of appropriate operational modes of electrical equipment in specific conditions is an important practical task.

**Objective.** Development of the shop electric network model, which allows to predict changes of the power quality indicators.

**Materials and results of the study.** Computational research based on the simulation system and the use for computer statistical tests allow significantly accelerate and simplify the research process [1]. This method differs from the conventional experimental methods in fact that not the object but its imitation model implemented on a computer is affected. In this case, the interaction with the latter is carried out in the same way as it would be done with the object under study, and the simulation results are processed and tested in the same way as if they were data from field trials [2].

Based on the features of an asynchronous motor functioning in the electrical network with poor quality electricity, its electromagnetic model should be supplemented with sub-system of random changes in power quality simulation. The latter can be realized by blocks for linear voltages formation in the electrical networks of the shop and calculation of these indicators.

One of the possible variants of the structure of the linear voltages random changes generator, taking into account the above mentioned is presented on the figure. 1[3]. Here:  $G_\gamma$  - the generator of the "white" noise (the values of the uniformly distributed uncorrelated random variable corresponding to the time moments  $\Delta t\gamma$ , in the interval 0;1)  $\Pi_{U_{mABi\gamma}}, \Pi_{U_{mBCi\gamma}}$  - converters of the laws of the distribution of amplitudes  $i = \overline{1, n}$  - harmonic of linear voltages  $U_{mAB}$  and  $U_{mAC}$ , respectively;  $\Pi_{\psi_{ABi\gamma}}, \Pi_{\psi_{BCi\gamma}}$  - converters of laws of distributions of initial phases of  $i = \overline{1, n}$ - harmonics of the specified voltages of  $U_{AB}$  and  $U_{BC}$ ;  $\Phi_{U_{mABi\gamma}}, \Phi_{U_{mBCi\gamma}}$  - filters that form the correlated amplitudes of harmonics of linear voltages  $U_{AB}$  and  $U_{BC}$ , respectively;  $\Phi_{\psi_{ABi\gamma}}, \Phi_{\psi_{BCi\gamma}}$  - filters forming correlated initial phases of harmonics of the same voltages;  $\tau_{(U_{mAB} \rightarrow U_{mBC})i}$  - is the displacement of the amplitude of the  $i$ - harmonic of the line voltage  $U_{BC}$  relative to the  $i$  - harmonic of the linear voltage  $U_{AB}$  along the axis  $\tau$ , determined from their cross-correlation function;  $\tau_{(\psi_{AB} \rightarrow \psi_{BC})i}$  - is the offset of the initial phase of the  $i$ -harmonic of the line voltage  $U_{BC}$  relative to the initial phase  $i$ - of the harmonic of the line voltage  $U_{AB}$  along the  $\tau$  axis, determined by their cross-correlation.

The instantaneous variations of the amplitudes ( $U_{mABi}, U_{mBCi}, U_{mCAi}$ ) and the initial phases ( $\psi_{ABi}, \psi_{BCi}, \psi_{CAi}$ ) of the harmonic components of the linear voltages, which are reproduced in this way, determine their instantaneous values. Then the latter are added algebraically in the adder, forming the random sequences  $u_{AB}(\Delta t\gamma)$ ,  $u_{BC}(\Delta t\gamma)$  and  $u_{CA}(\Delta t\gamma)$ .

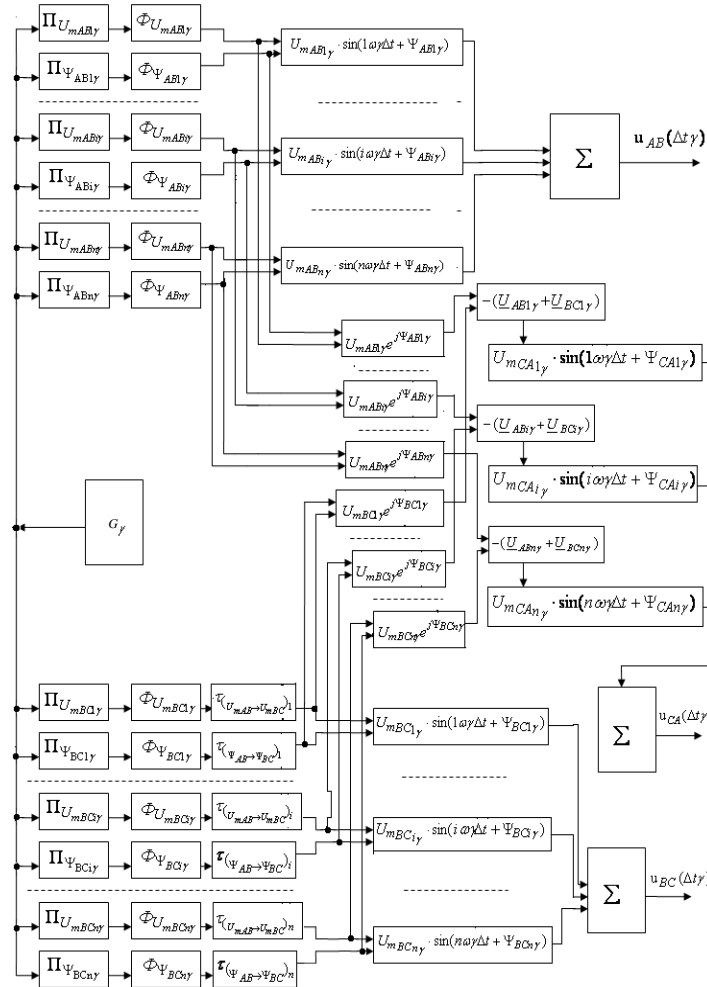


Figure 1. The generator phase voltages

Conclusions. The study of electrical equipment efficiency in electrical networks with low-quality electricity is expedient to be carried out on the basis of computational experiments using linear voltage generators, developed on the basis of the method of statistical tests.

### References

1. Strohalev, V.P., Tolkacheva, Y.O. (2008). Simulation modeling. Moscow, Russia: MSTU. Bauman.
2. Skurykhyn V.Y., Dubrovskiy V. V., Shyfryn V. B. Mathematical modeling (1983). Kiev, Ukraine: Naukova Dumka.
3. Kachan U. G., Nikolenko A. V., Kuznetsov V. V. (2012) On modeling of voltages in electrical networks of industrial enterprises [Electrical engineering and electrical energy]. №1, pp.72-75.