Investigation of Reaction Transformer Active Power to the Complex Load

Andriy Vytiaganets

Abstract **- The influence of the complex coefficient conversion transformer on the error of measuring the power at different ratios between active and reactive power in transmission lines is investigated.**

Keywords – - **measuring transformer, active power, a complex load**

I. INTRODUCTION

The problem of measurement of active power is multiplying the instantaneous current and voltage in the transmission line in a broad band of frequencies. In most cases, the multiplication is achieved by different methods of multiplying the electrical signals that are proportional to the voltage and current. In this case, the voltage dividers and converting transformers are used. Using the converter transformers is limited because of the phase and amplitude distortion that the transformers make in the scheme of measurement in a wide frequency band. Attempts to use Hall generators as direct factors of voltage and current in the circuits are carried out with difficulty, because of the great influence of spurious signals, thermoelectromotive power, straightening, etc.

These shortcomings are largely absent in transformers on the basis of ferromagnetic films [1]. Since the films are metal, then the value of thermoelectromotive power is much smaller and it can be eliminated by the choice of the connecting wires, which do not form the rectification at the contacts.

In the basis of the proposed transformer active power is poot the use of galvanomagnetic phenomena - the anomalous Hall effect and magnetoresistance effects in ferromagnetic films [2].

II. MAIN PART

The basis of the converter is a film of magnetoresistive 80Ni20Fe alloy being deposited on the polished ceramic substrate by electron-beam method. The converter consists of four loop like branches, which are connected at a branching. Each branch is formed by two strips connected in series with copper conductors. The proposed structure of the converter has the form of electric resistive bridge, Fig. 1.

Fig. 1. Sensitive element of magnetoresistive converter

Andriy Vytiaganets - National technical university of Ukraine "Kiev polytechnic institute", Peremoga Av., 37, Kiev, 03056, UKRAINE.
E-mai: vytiaganets@gmail.com

Output voltage measuring transformer of active power is associated with the active power in transmission line as

$$U_0 = \frac{\Delta\rho}{\rho}\frac{1}{H_0}\mathrm{Re}\left(Vh^*\right) = \mathrm{Re}\left(k_U k_I^* UI^*\right) = k_P UI\cos\varphi_{UI}, \quad (1)$$

where V, h – corresponding the complex amplitude of the input voltage alternating signal and intensity of magnetic field; $\Delta\rho/\rho$ – the anisotropy of the magnetoresistance of magnetoresistor material; H_0 – the external magnetic field intensity; k_U – a complex proportionality factor between the voltage transmission line U and the input voltage on the transformer V; k_I – a complex proportionality factor between the current in transmission line I and the magnetic field conductor with current h; k_P – the conversion factor of magnetoresistive transformer.

The expression for full field detection by magnetic film of electric field has the form

$$E_{0i} = \frac{1}{2}\mathrm{Re}\left(\kappa_{ipl} h_l J_p^*\right), \quad (2)$$

where κ_{ipl} – are the components of the magnetoresistive susceptibility of the magnetic film.

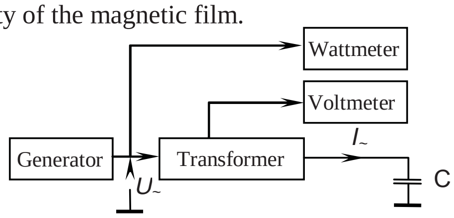

Fig. 2. Measuring power scheme

Block diagram of the measuring system for experiment with reactive power is shown in Fig. 2. This experiment allowed to estimate the influence of reactive power at converter operation. The measuring transformer determines the active power in the electric circuit, where the reactive power the thirty-five times higher than the active power.

III. CONCLUSIONS

Using magnetoresistive susceptibility tensor taking into account the phase shift between the magnetization and the magnetic field reaction transmitter active power to the complex load is investigated, i.e. the influence of the reactive component of the integrated power and purely reactive load because of errors in the output of the converter. Reactive power in transmission line through the phase shift between the magnetization and the magnetic field gives an error of measurement transformer magnetoresistive of active power.

REFERENCES

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