PROBE OF PROCESS OF MULTIPLE-LOOP CHAINS OF PARALLEL AND CONSECUTIVE JOINTS.

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Abstract. The article describes the formation of low-frequency currents in ferromagnetic oscillatory circuits. As a result of parallel and serial connection of multi-loop ferroresonance circuits, the frequencies of harmonics of the second-order amplitude of soft excitation are considered. Each of the schemes in the article is analyzed, and taking into account the industrial use of frequency converters, it makes it possible for further research on the production of frequency converters.
Keywords: system, sequential, winding, magnetic flux, oscillations, frequency, harmonics, transformer, semiconductor, excitation, parameter, amplitude, circuit, current, auto-parametric, voltage, source, contour, nonlinearity, equation.

Introduction

At a certain intensity of change in the nonlinear circuit parameter, the natural frequency of the oscillating system corresponding to the equivalent parameters of the circuit may be equal to half the frequency of the driving force, and then subharmonic oscillations with large amplitudes are excited in the system.

Studies have shown that simple ferromagnetic circuits when excited by an autoparametric oscillation (APO) at the subharmonic frequency (fig-1., fig-2.) with a single ferromagnetic element L (i) or with a nonlinear capacitance C (u), a lot of work has been devoted to: [3,4,5,6,7,8].

It is assumed that in general, the frequency APO is equal to

It is considered to be that generally frequency of agrarian and industrial complex is equal:

Ω=K*ω (1)

where ω- frequency of the power source.

At K=1/2;1/3;1/5············ 1/n in ferroresonance a circuit the subharmonic resonance takes place, and at K=2;3 etc. a polyharmonious resonance, and if K=1, that Ω=ω, and in a chain the resonance on the main harmonic takes place.

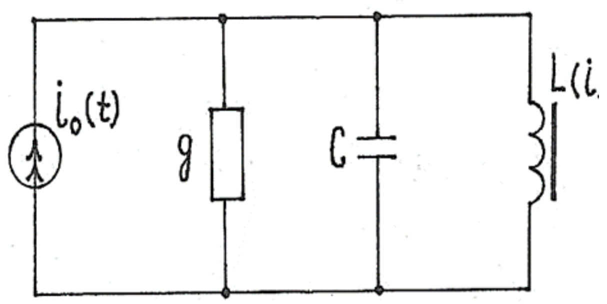

Fig-1

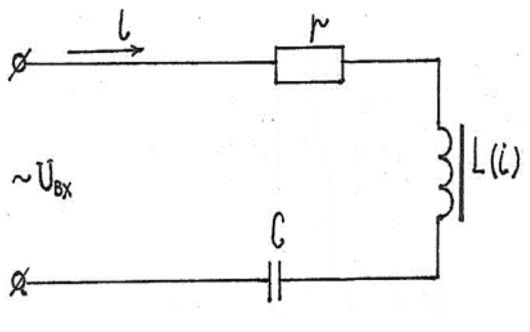

Fig-2

It is known that excitation subharmonic oscillation (SHO) in electroferromagnetic oscillating circuits (EFOC) has a number of specific features and depends on a ratio of parametres of a circuit and entry conditions. In some cases, for example, at smooth change of input voltage mode SHO can pass in a self-oscillating mode with small frequency which represents more difficult type of nonlinear oscillations.

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https://doi.org/10.1051/e3sconf/202021601142

Any oscillatory system is potentially self-oscillating because even at what absence or, practically always taking place, casual индукций or charges (a transmission line, atmospheric categories), always are available certain entry conditions which can call excitation of autoparametrical oscillations at the expense of the saved up charges or casual inductions. Thus frequency of the raised oscillations in multiple number of times is less, than frequency of changes of parametre [1, 6].

In schemes of the second group excitation SHO does not depend on value of an initial charge on the condenser though the phase and amplitude of input voltage and value of a current magnetization influence excitation process.

To one of classical schemes for excitation SHO of the second order serves, the so-called, balancing scheme (fig-3), Consisting of two identical transformers A and B, primary coil 〖W〗_1which are engaged consistently and agree, and secondary W_2 consistently and counter. Winding undermagnetization 〖W〗_0 it is engaged thus, that the magnetic stream created by it, develops with a magnetic stream in the centre hub transformer's A it is subtracted from a magnetic stream in the centre hub B the second transformer. For excitation APO on frequency SHO on a chain exit «а-в» it is necessary to connect capacity C.

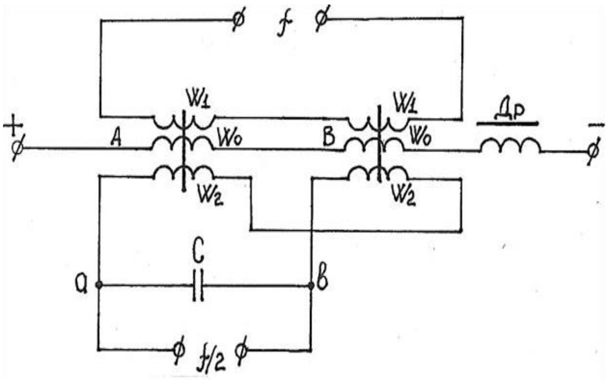

Fig-3

Magnetizing forces for each of transformers will be equal:

$$F_A = I_0 * W_0 + I_1 * W_1 \;;$$
$$F_B = I_0 * W_0 - I_1 * W_1 \quad (2)$$

As a result, weber-voltage characteristic of a separate transformer becomes asymmetric. Generally speaking, total pressure of the main frequency on target clamps "а-в" is equal to zero, as pressure on windings 〖W〗_2 on this frequency are shifted on 180 electric degrees. However on these target clamps "а-в" there can be a pressure as a result of excitation of autoparametrical oscillations. Here form such phase-frequency ratio between components of the main harmonic and SHO that the target chain and a pumping chain "are untied" on frequency.

Arisen SHO are supported, thanks to receipt from a source of higher frequency of portions of energy with frequency to multiple frequency of voltage output. It occurs owing to periodic change of parametre of a ferromagnetic element under the influence of a source to frequency twice greater frequencies of voltage output. The primary coil of the given transformer serves, thus, only for periodic change of nonlinear parametre which is made most intensively when the circuit is adjusted on half frequency of the power source.

Thanks to it, there is the best capability for underholding and strengthening's of the oscillations which have arisen in a circuit on frequency SHO. Disturbing force acts to such oscillations, periodically covering the active losses interfering increase amplitudes SHO.

The main advantage of parametres is their speed, i.e. rather small time of transition from one phase condition in another, based on use semiconductor elements. It, in turn, has formed base for creation over high-speed electronic computers.

Processes in power ferromagnetic dividers of frequency have the same nature, as parametres. However, use of autoparametrical chains with semiconductor elements divider's industrial frequency has not found operational use in a mode in view of relative smallness's capacity р-п transition.

One of advantages of existing semiconductor dividers of frequency is the capability to change frequency in a broad band. Despite it, their application for obtaining of underfrequencies is inexpedient in view of complexity of the control circuit and insufficient overload ability. In such cases it is more rational to use ferromagnetic dividers of frequency, as more simple in manufacturing and operation.

Multiple-loop ferroresonance chains was expediently differ from single-flow multistability of phase conditions and ability to provide stable agrarian and industrial complex on predominating frequencies. From the point of view of creation of particular schemes of transformation of frequency and number of phases, they represent the big theoretical and practical interest. As allow to realize those properties ferroresonance converters which was expediently distinguish them from thermistors, namely: simplicity of execution and reliability increase in operation substantial improvement of the form of a curve of voltage outputs, a capability of simultaneous transformation of frequency and number of phases.

Other problem which allow to decide multiple-loop ferroresonance chains, transformation of number of phases for feed of multiphase loading by a current of non-standard frequency from a single-phase source is. Thus set phase distribution in ferroresonance converters does not depend on loading parametres.

The problem of obtaining of a multiphase source of pressure required frequencies is decided or by grouping single-phase ferroresonance the circuits actuated consistently or in parallel, or by means of multiphase transformers.

Known to us from classical literatures with a three-phase exit can be divided converters into two types. The first type-it ferromagnetic converters of frequency (FKF) executing as transformation of frequency and number of phases [5,7] The second type put down FKF, implementers only transformations of frequency without change of number of phases on an exit [4].

The principle of transformation of frequency in both cases is based on excitation of autoparametrical oscillations in EFOCCO n frequency of a subharmonic. Feature similar multiple-loop ferroresonance chains is mutual magnetic field influence of one phase on another owing to what there is a magnetic field component in each of centre hubs. At the expense of this component and other harmonics, phase pressure are deformed under the form and on amplitude. Linear pressure are subject to these distortions to a lesser degree though there are asymmetrical on the amplitudes. In this scheme presence of the automatic pull unit is supposed.

Automatic trigger device (ATD) for maintenance of a preset value of an initial phase of the applied pressure at excitation APO and stabilisation of an order of alternation of phases. To a chain of the second type it is possible to attribute ferroresonance the chain which has become classical and received name "balancing". The scheme on fig-3, applied as the frequency divider twice, consists of two identical transformers Aand Bthe linear condenser C [8-10].

However, if a secondary coil of this scheme to consider conditionally as a twocircuit chain, it will be divided the linear capacity forming together with nonlinear inductances of transformers A and B two ferroresonance a circuit here we deal with the division of frequency accompanied by simultaneous multiplication of number of phases in the same frequency rate (fig-4 (a)) we here receive in these circuits frequency division twice, and pressure SHO U_a0and 〖U〗_B0are shifted from each other on 180 electric degrees.

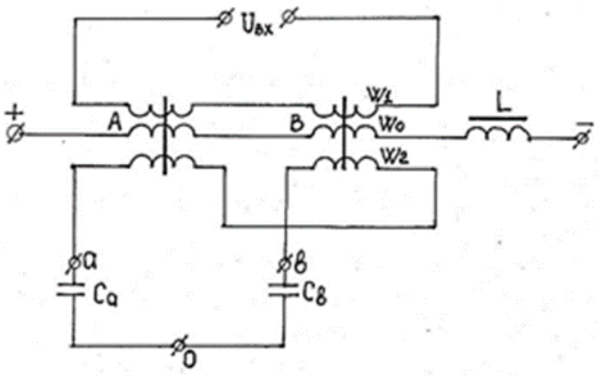

Fig-4 (a)

For the purpose of the further studying of the multiple-loop EFOCC, from the point of view of excitation in them APO on frequency SHO the second and third order, in the presence of a winding undermagnetization to a chain about two in parallel actuated ferroresonance oscillating circuits, we will connect one more circuit and we will lead to its kind presented on (fig-4 (b))

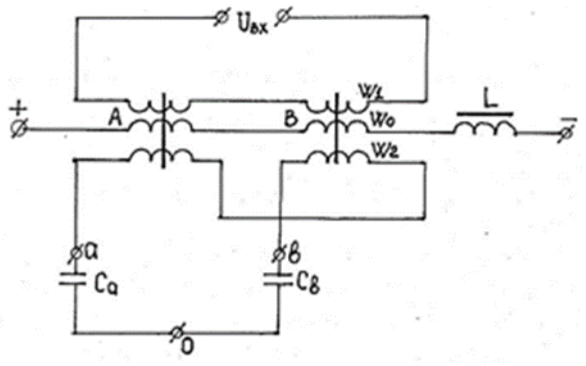

Fig-4 (b)

To multiple-loop ferroresonance to chains three-phase chains in which arise concern also APO. Excitation processes APO three-phase chains are in detail enough investigated [1,4,7,8]. In these activities the analysis of stationary modes by means of the truncated equations of Duffinga is carried out. It let to determine influence of various factors on an excitation and existence mode SHO at three-phase effect on ferroresonance a chain. However, thus there was obscure an interaction of phase ratio between input voltages and SHO, and also conditions of maintenance of unambiguity of phase conditions and symmetry of voltage outputs on in amplitude.

Excitation APO this or that frequency, peak and phase ratio in a three-phase chain it is determined by phase conditions of each of ferroresonance circuits.At excitation APO in one of three parallel ferroresonance circuits (fig-5) other two circuits are involved in oscillations [11-13].

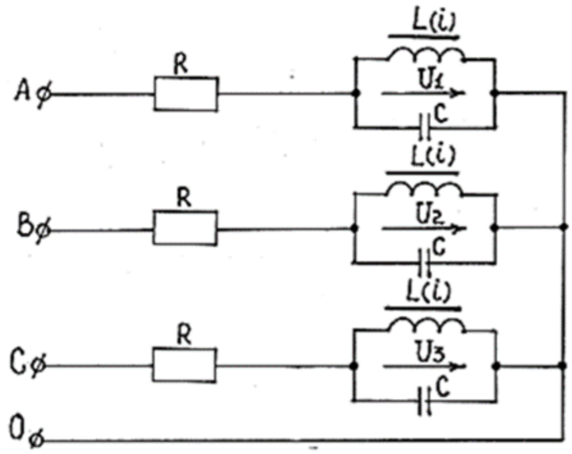

Fig-5

Thus the equilibrium between input voltages 〖U〗_AB 〖,U〗_BC 〖,U〗_CAand voltages in ferroresonance circuitsU_1 〖,U〗_2 〖,U〗_3 also ambiguous. Generally, in three-phase system shifts of phases between pressure SHO the third order can be established in three versions:

2π/3 ; (4π)/3 ; (6π)/3. (3)

Probes of conditions of excitation and steady maintenance APO in multiphase chains have shown that some features, in particular, connected with phase ratio between АПК and the power source, allow to create multisteady elements and devices from phases discrete properties which can be applied in various areas of engineering. One of important features of multiphase systems is also that the number of phase conditions is increased with growth of an order of a subharmonic [14-16].

Conclusions

Thus, there are some phase conditions, satisfying to values of phase and linear pressure on frequency SHO, that is phase conditions SHO in each of ferroresonance circuits determine amplitude of arising oscillations on this or that harmonic.

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