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THE SPREAD FREQUENCY MODULATED SIGNALS TYPE OF ANISOTROPIC PLASMALIKE TYPE

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Introduction. The solution of the problems of interaction of electromagnetic wave (EMV) and hydrocarbon Deposit (UVZ), located on the background of heterogeneous and polyphase medium is due to the complex physical processes over hydrocarbon deposits, their occurrence conditions. Until recently, the electrodynamic description of the underlying inhomogeneity was reduced to its representation in the form of "a body with finite conductivity immersed in a medium with losses".

Currently, there are several physical models of hydrocarbon deposits, taking into account the migration of hydrocarbons in the environment above the deposits to the Earth's surface. In this case, the influence of electromagnetic signals on such formation can be described as single – resonance and multiresonance interaction [1–3].

In modern intelligence there is a tendency of emergence of new methods connected with complication of techniques and technologies which seek to reduce time of certification of the controlled surface and to increase quality of operational characteristics [4]. A greater number of proposed methods have no theoretical justification, sometimes contrary to the canons of physics. All this requires a thorough analysis of the physical processes occurring over the hydrocarbon field, concretization of its electrodynamic model to justify the interaction of EMF with the Deposit.

The aim of this work is to develop electromagnetic methods for searching anisotropic plasma-like media (ASPT) on the basis of the studied characteristics of the surface impedance of media in the mode of frequency-modulated (FM) signals.

The interaction of the computer with ASPT. Studies on this topic are presented in [5]. However, the peculiarities of interaction between EMV with UVZ in this mode impacts require further analysis.

The investigated carbon can be represented as an anisotropic inhomogeneity on the communication path [6].

In General, the spatial orientation of the external normal to the interface of the media and the wave vector k EN is arbitrary (figure 1) and the process of interaction of the EMF with the local inclusion on the RRV path can be represented as a mode of inclined plane wave incidence with vertical polarization to a boundless surface with an anisotropic impedance (in the approximation of large characteristic sizes of inhomogeneity in comparison with the wavelength of the probing signal) [2].

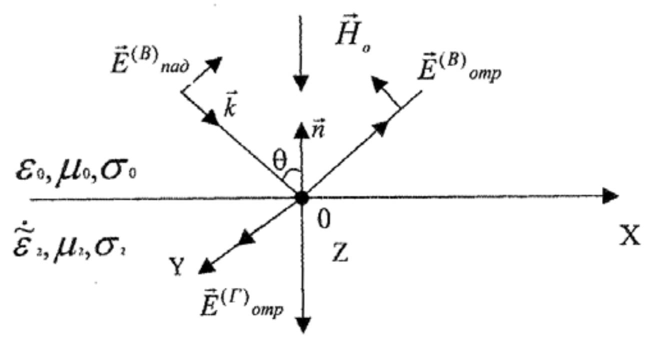

Figure 1. Geometry of the problem for EMV with vertical polarization of the field

Then the impedance boundary conditions give:

$$\begin{gathered} E_x = -Z_0(\dot{Z}_{11}H_x - \dot{Z}_{12}H_y), \\ E_y = -Z_0(\dot{Z}_{21}H_x - \dot{Z}_{22}H_y), \\ \dot{Z}_{11} = \dot{Z}_{22} = -\frac{1}{j2\sqrt{\dot{\varepsilon}_R\dot{\varepsilon}_L}}\left(\sqrt{\dot{\varepsilon}_R} - \sqrt{\dot{\varepsilon}_L}\right), \\ \dot{Z}_{11} = \dot{Z}_{21} = \frac{1}{2\sqrt{\dot{\varepsilon}_R\dot{\varepsilon}_L}}\left(\sqrt{\dot{\varepsilon}_R} + \sqrt{\dot{\varepsilon}_L}\right), \end{gathered} \tag{4.2}$$

where E_ (x,y), H_(x,y) – projections of the incident and reflected waves on the corresponding coordinate axes;

Z0 is the characteristic resistance of the medium surrounding anisotropic inhomogeneity.

Results of the study of surface impedance. With the help of Matlab software the analysis of frequency components of the surface impedance of the medium over UVZ is carried out at the change of parameters of PM, the variation of which extends the functional dependence of the resistance components on modulation modes and allows to increase the informativeness of the developed methods for searching UVZ.

The frequency dependences of the impedance boundary conditions on the segment from 105 Hz to 1010 Hz are investigated, the influence of the frequency modulation index and the modulating frequency on the surface impedance characteristics is considered.

Calculation of surface impedance components (4.2) was carried out on the basis of experimentally obtained data over hydrocarbon deposits: dielectric permeability of host rocks ε_r= "\1\0", specific electrical conductivity δ_r=0,"\0\3" "\C\m " / m; effective frequency of collisions: electron-ion u_e= 〖"\1\0"〗 ^9 c^(-1) and ionic u_i=0,5· 〖"\1\0"〗 ^7 c^(-1)[5].

Figures 4.2 and 4.3 show the frequency dependences of the component Z_{11}. To highlight the HS-levothrodi deposits in part of the impedance Z11 can recommend the following frequency: 1,15·108 Hz and 1.45·108 Hz (At=0,5).

For the frequency modulation index b = 1 the input impedance is characterized at frequencies of 9.8·107 Hz and 1.2·108 Hz. When increasing the modulation index to H = 10 is offset from the points of extremum of the Z11 to the left. At a frequency of 9.8·107 Hz the module is 0.2, and at a frequency of 1.2 * 108 Hz the module is 0.25.

The increase in index world Cup leads to the fact that the extremum at frequencies of 0.54·106 Hz and 0.98·107 Hz vary insignificantly in comparison with the smaller values of the index of frequency modulation. The following frequencies of 1.1·106 Hz and 1.38·108 Hz (at B = 15) can be recommended for the allocation of hydrocarbon deposits on the impedance component |Z11|. For the frequency modulation index B=25 at frequencies 0,50·106 Hz and 0.94·107 Hz and for the frequency modulation index B=50 there is an offset of extreme points |Z11| to the left.

At a frequency of 0.96 * 107 Hz the module is equal to 0.22, and at a frequency of 0.48 * 106 Hz the module is equal to 0.175. The increase in index world Cup leads to the fact that the extremum on the frequency is 0.94·107 Hz and 0.90·107 Hz vary insignificantly in comparison with the smaller values of the index of frequency modulation.

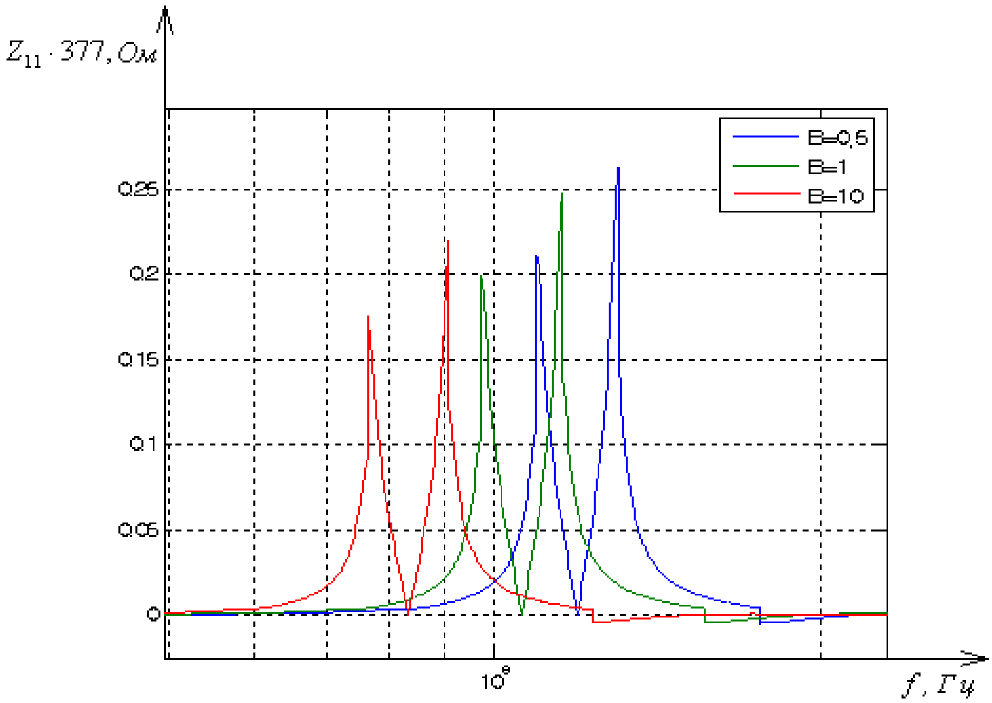

Fig. 2. Dependencies $Z_{11} = \psi(f)$: 1 – for B=0,5; 2 – for B=1; 3 – for B=10

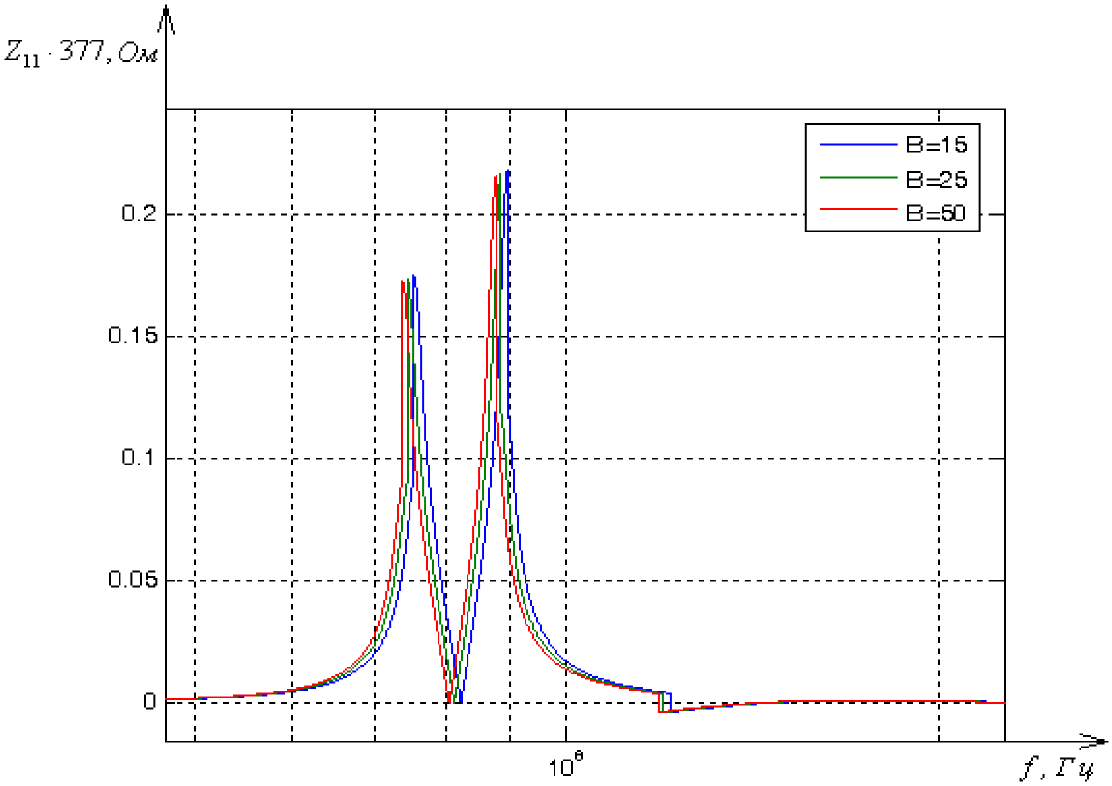

Fig. 3. Dependencies $Z_{11} = \psi(f)$: 1 – for B=15; 2 – for B=25; 3 – for B=50

The frequency dependences of the component Z_{12} are shown in figures 4.4 and 4.5.

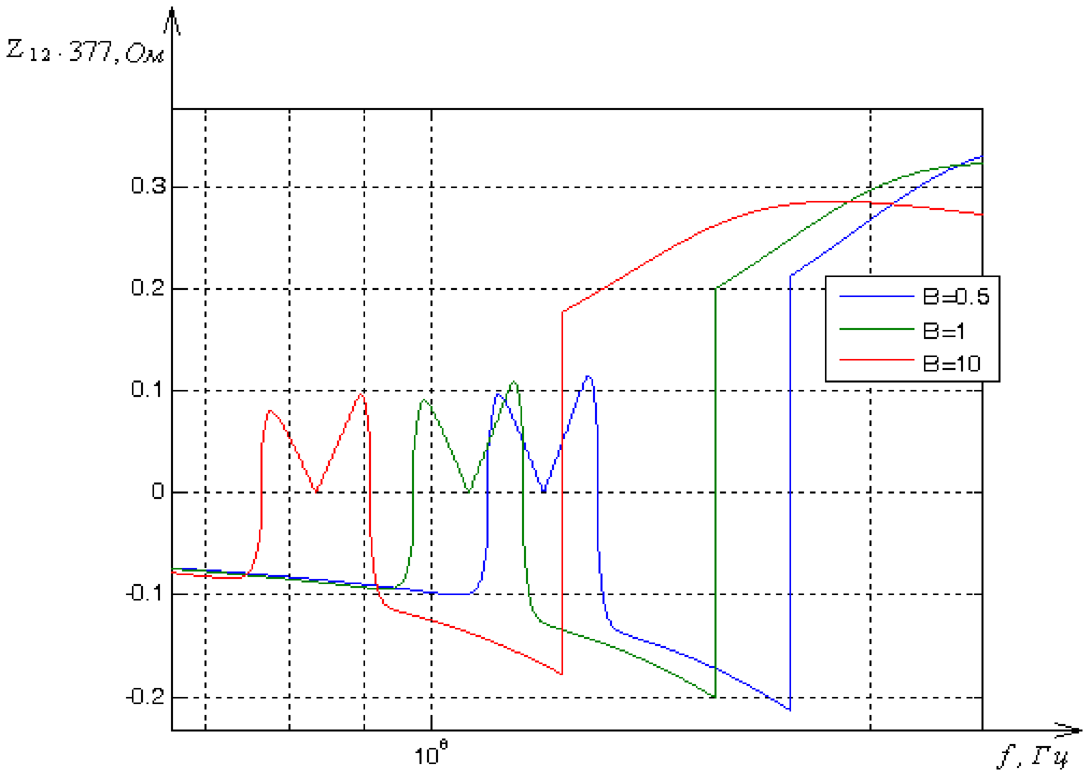

Fig. 4. Dependences $Z_{12} = \psi(f)$: 1 –for B=0,5; 2 – for B=1; 3 – for B=10

The value of the component of the surface impedance Z_{12} is virtually unchanged in the frequency range from 105 Hz to 108 Hz. At a frequency in the range from 100 MHz to 180 MHz there is a sharp surge to values of 0.28-0.35. The variation of the index In effect on the interval of frequencies from 100 KHz to 1 GHz. Lower values of index B correspond to higher values of Z_{12} and higher values of the frequency at which the growth of surface impedance is observed.

The value of the component surface impedance| Z_{12} / virtually unchanged in the frequency range from 105 Hz to 108 Hz (at B = 15 – 50). At a frequency of 300 MHz there is a sharp surge to the values of 0.17. The variation of the index In effect on the interval of frequencies from 100 KHz to 1 GHz.

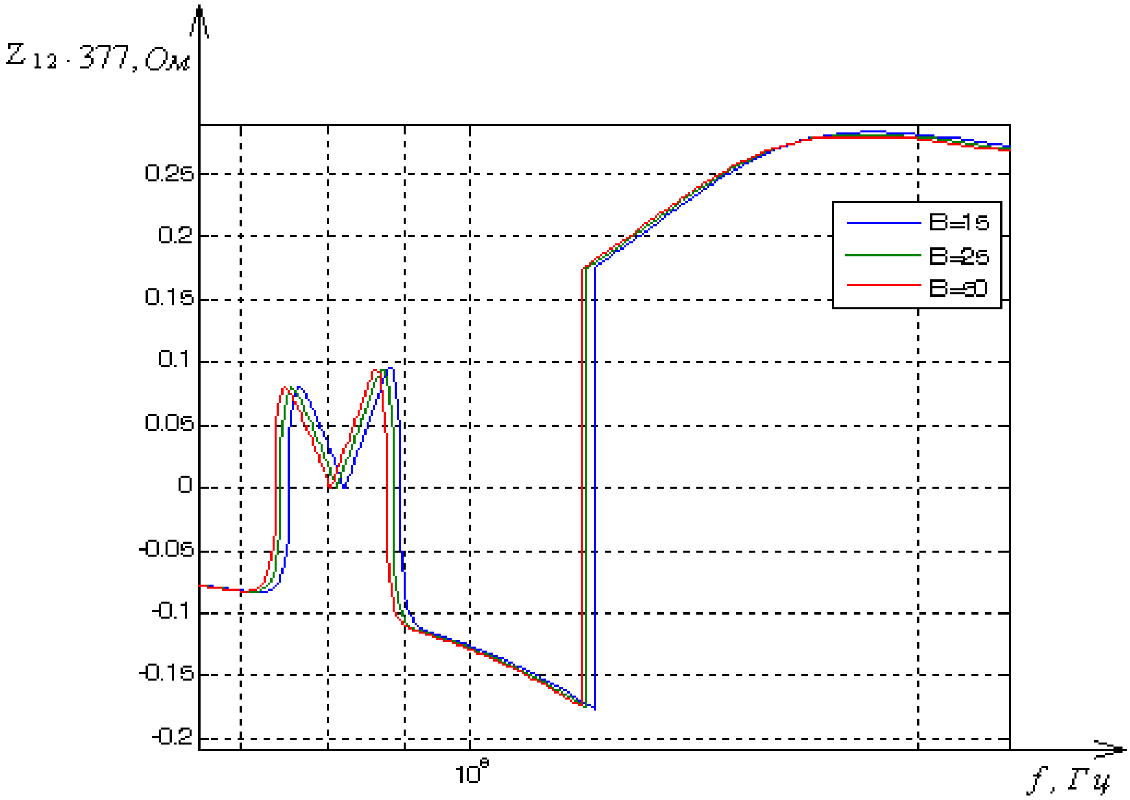

Fig. 5. Dependences $Z_{12} = \psi(f)$: 1 – for B=15; 2 – for B=25; 3 – for B=50

Lower values of index B correspond to higher values of Z_{12} and higher values of the frequency at which the growth of surface impedance is observed.

The impedance of the plasma-like layer under study is a complex value. Thus, the analysis is reduced to a separate study of the amplitude and phase characteristics of the surface impedance. The analysis of the amplitude characteristics of the surface impedance was carried out in this paper. The quantitative manifestations of these effects are determined by the physical and geological properties of oil and gas fields: chemical and mineralogical composition of the layers, structural and textural features of the skeleton, the nature of porosity and permeability, the percentage content of constituents, the characteristics of the mechanical properties of the skeleton, the amount of formation water in pores, its mineralization, etc., so in terms (4.2) it is necessary to take into account the amendments to these characteristics.

Conclusion. The paper identified the values of the components of the surface impedance of aspt, in which the Deposit of hydrocarbons was selected. The propagation of electromagnetic effects ' above the accumulation mode in the FM signal. The analysis is carried out in the impedance-frequency range of probing signals. Various modes of application of FM modulation are considered. The obtained results of interaction of PM signals with the environment over UVZ can be applied to the development of RTS of oil and gas deposits search and qualitative improvement of geological exploration performance.

The analysis of the surface impedance of the environment on the Uralvagonzavod, the largest of which can evaluate the characteristics of the antennas having a fixed position in space relative to the boundary line when you change the properties of the underlying surface, which gives the possibility to quantify the properties of the medium, without resorting to the exact calculation of the changes of the electrodynamic parameters of the underlying surface.

The results of the study can be used to develop new electromagnetic methods for search and contouring of UVZ.

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