The Shortening Faults Handling Of High Voltage Lines Loaded By The Electric Traction Dependent Office

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The railroader electric traction system in Europe and especially in Romania is realized at 27,5KV nominal voltage and 50Hz frequency. The electrical energy supply is realized by the 110KV/27,5KV electric traction dependent offices which injects the voltage into the contact line through the supply cables. The electrical engines capture this voltage through the pantograph . The contact line is a non-conductive electrical network submitted to the faults of insulator perforation and the electrical engine is a moving user also submitted to some insulator faults. It is necessary a sentinel in order to observe these faults and disconnect the user in case of shortening.

Chapter 1. Destination

The impedance relay with a strophoide monophasic characteristic is designated to implement the 27,5KV contact network feeder cells into the railroad electric traction, enclosed this way in the electrical system complex protection devices category.

Chapter 2.Current Status

There are known many types of impedance relays for the shortening protection of the railroad contact network as follows:

-circular characteristic relay that realize a circular fault surface with a border passing through the coordinates axes origin (R, j, X). This relay has the disadvantage of a big difference between the fault square area and the action zone area. Considering the user's particularity, the relay doesn't guarantee an adequate reserve for the overcharge duty, leading to fider switch display, without any fault in the network. Also it isn't assured the supply selection of the very long fiders.

-it is also well known that an impedance relay which realizes an elliptical characteristic with one of its focal points in the axes origin (R, j, X). This relay has a comparison impedance which can be regulated in stages. In conditions of traffic intensification, as the contact network is overcharged, this device doesn't offer an adequate reserve and also in case of line supply at two ends, the (electric) arc reserve is inadequate.

-other measurement element for the electrical lines distance protection is the comparison, during the current line passing through zero, of some alternative voltages, obtained by protected line voltage and current signs handling: a voltage proportional with the one of the line, but phase shifted from that with 90 degrees plus the bending angle of the faults square from the imaginary axes, with a voltage proportional with the fault (electric) arc resistance which leads to a logical signal equal with one at the output, if the impedance phaser is inside the fault square. This circuit realizes a square characteristic situated inside the first cadre which presents the disadvantage of metallic shorten false action possibility.

Chapter 3.The structure of the impedance relay with strophoidal characteristic

The impedance relay with strophoidal characteristic provide a real protection to the railroader electric traction, eliminating the previous solutions disadvantages.

The relay is built of two transformers, followed by rectifier bridges which provide a circular characteristic and a transformer with quick saturation, followed by a reducing comparing impedance only in case of a phase-shifting charge (to the dephased charge), the diagonal measurement of the three bridges being connected to a direct polarity amplifier detector ant through an impedance box regulator.

The adjustment is made continuously this being the first stage(step) in the device operation. Similarly, it’s obtained the second stage(step).

Both stages can be adjusted continuously between 4-40 ohm, this allowing any supply configuration to the contact line.

The construction of the device was done starting from the equation of the straight line drawn in the admittances plane.

$$|Y_{TU}| = |Y_{TU} - Y_{TCU}| \qquad (1)$$

The admittances indexes correspond with the components indexes from fig.1

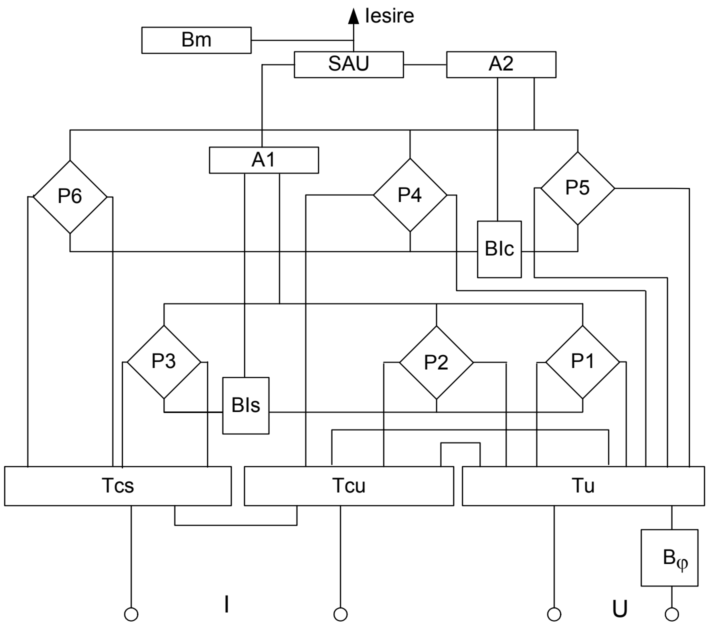

Fig. 1. Block diagram of the impedance relay with strophoid characteristic

The physical equation of the circular characteristic it's being made from a secondary potential transformer coiling T_U applied on the rectifier bridge P1 and from the transformers T_U and T_{CU} vectorial secondary voltage difference, applied on the rectifier bridge P2. The transformer T_{CU} has the magnetic core with electrical gap; it is an element of phase shifted voltage to the secondary coiling hubs, compared with the primary voltage of the transformer. The equation (also the circular characteristic) it's obtained composing the vectorial of the quantities found on the secondary coils above of the described transformers and comparing their absolute values on the rectifier bridges P1 and P2.

The introduction of the transformer with quick saturation (T_{CS}) has the primary coil serialized with the T_{CU} coil. That leads to a diametral flattening of the circular characteristic. The diameter passes through the axes origin.

From the gain of the secondary coil and from the rectifier bridge P3 is obtain the strophoid curve(fig 1);this curve it's caracterized by small absolute values impedance, at phase shifted charge and high reserves for short-circuits with arc (electric).

$$\left|Y_{TU}\right| = \left|Y_{TU} - Y_{TCU}\right| - \left|Y_{TCS}\right| \qquad (2)$$

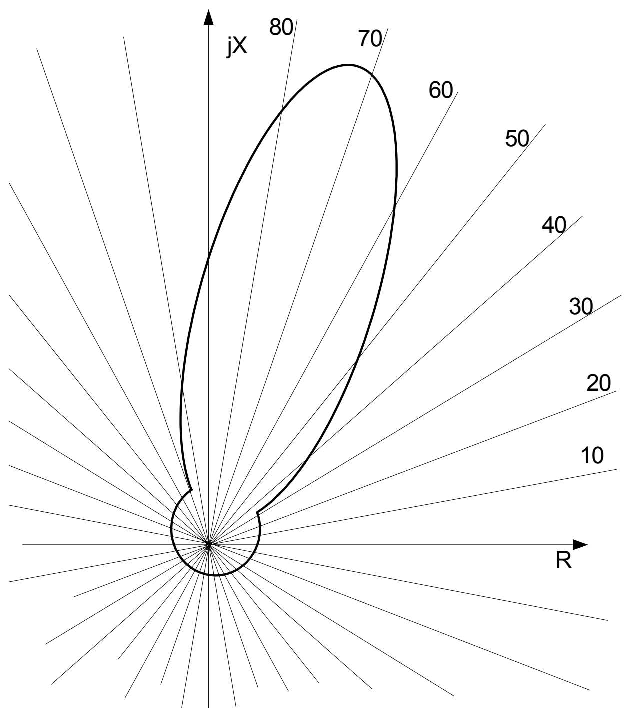

Fig. 1

Fig. 2 Impedance relay characteristic

The realization of the sensitiveness angle is made through the B(φ) box, who is inserted in the primal voltage circuit and who is builded by the dephasing parts. The modulation of the regulated impedance is made through the B_{Is} box; this box modify the gain of each electrical parameters from the rectifier bridges P1,…P6. The resulting parameters are applied at amplifier A1 and A2 inputs.

B_m block stores the information concerning, at least , the last ten decouplings and assures their transfer in real time or at request to an supervisory control for the summarization purpose.

Conclusions:

The device presents the next advantages:

-simple, solid and small size construction;

-safe functioning;

-extended functioning possibilities in different supply schedules, even in the I.R.E. networks;

-memorizing possibilities of the last ten events and their transmission to the dispatcher point.

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