



PS1 – Poster-16



Definition of Direction of Capacity Current's Protection with One Entrance Parameter

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KEYWORDS

Capacity direction, current's protection, a corner between a current and voltage.

1 INTRODUCTION

For selective action of transmission line protection with a feed from two parties or ring transmission line [1] use relay KW1 of a direction of capacity which is connected to measuring transformers of current TA1 and voltage TV1 (**fig. 1**) current (or distance) protection with the special directed characteristic of operating. At course of capacity from tires in line relay of a direction of capacity allows current to disconnect to protection damage (K1) switch Q1, and at course of capacity from a line to tires relay of a direction of capacity forbids current to protection to operate on switching-off (K2).

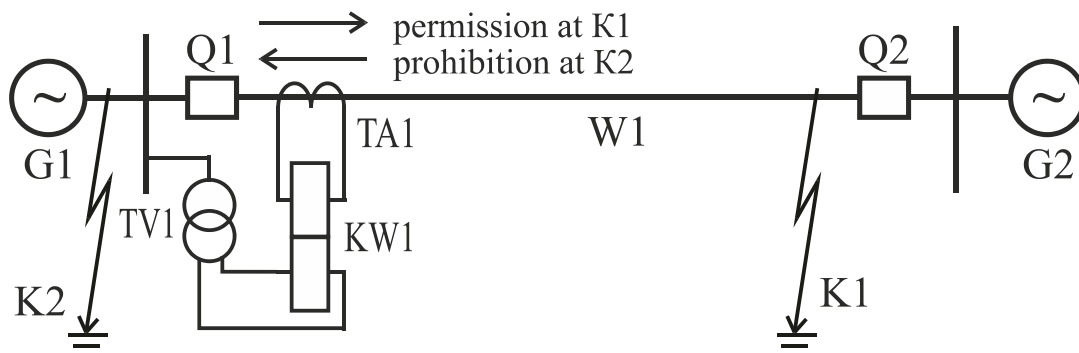


Fig. 1: Connection of the usual relay of a direction of capacity

On the one hand use of several entrance chains lowers reliability of protection, on the other hand, when many devices are connected to the transformer of voltage TV1 it is overloaded, admissible accuracy of work. All these factors have pushed to creation relay of a direction of capacity with one entrance parameter – current.

2 BASIC PART

2.1 Purpose

The given work is devoted creation токовой the directed protection with one current in entrance parameter. It will allow to simplify the connection scheme a little.

2.2 Theoretical preconditions

The algorithm of action [2, 3] of the relay of a direction of capacity with one entrance parameter is offered. The action principle consists that define the generated basic signal by storing of duration of the previous period of a current, and a time equivalent of a corner by increment calculation between the generated basic signal and duration of the current period of a current.

The algorithm of action of the relay of a direction of capacity with one entrance size is offered. The action principle consists that define the generated basic signal by storing of duration of the previous period of a current, and a time equivalent of a corner by increment calculation between the generated basic signal and duration of the current period of a current.

The essence of algorithm can be considered on an example of diagrams of basic possible modes of transmission line, thus, remembering that the positive increment between duration of the previous period and flowing means inclusion of inductive loading, and negative – capacitor; and conditions for protection operation are: $\Delta t > t_{\Delta 1}$, $\Delta t < t_{\Delta 2}$, $I_{\Delta} > I_{\Delta 3}$ (where $t_{\Delta 1}$ and $t_{\Delta 2}$ – the first and second reference parameter of an angular equivalent; I_{Δ} – a line current; $I_{\Delta 3}$ - reference parameter of a current):

a) Operating conditions, with a small increment of a corner of loading (**fig. 2**). In this case an increment between duration of the previous period and flowing it is insignificant, that is the increment of a time equivalent of a corner of less that first and second reference sizes of an angular equivalent, simultaneously a line current doesn't increase and doesn't exceed reference parameter of a current, therefore protection of transmission line doesn't work $\Delta t < t_{\Delta 1}$, $\Delta t < t_{\Delta 2}$, $I_{\Delta} < I_{\Delta 3}$;

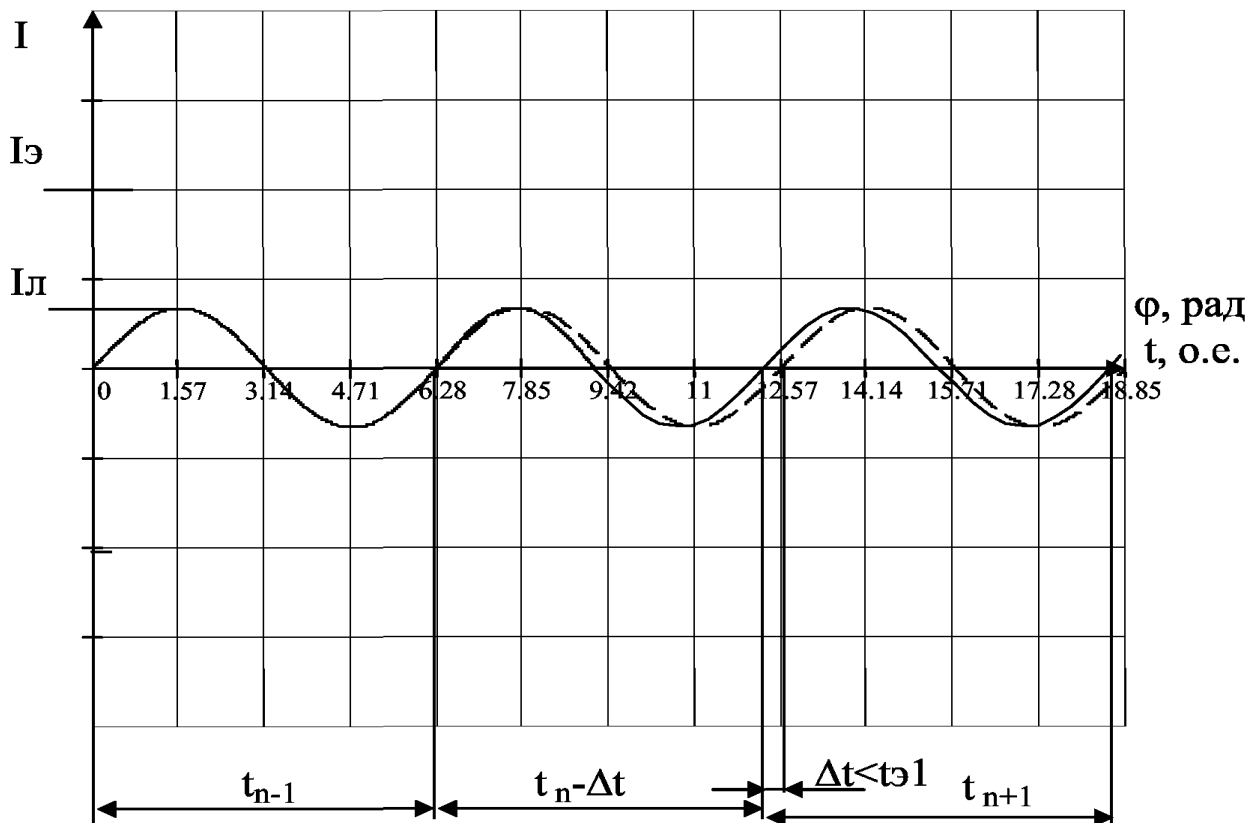


Fig 2: Diagram of normal operating conditions with a small increment of a corner of loading

b) Operating conditions, with the big increment of a corner of loading (**fig. 3**). Such mode can arise, for example, at connection of powerful inductive loading, change of overflows of capacity of transmission line, etc. Thus a time equivalent of a corner more than the first and less than the second reference sizes of angular equivalents, but thus less than reference size of a current – protection of transmission line doesn't work a current: $\Delta t > t_{\Delta 1}$, $\Delta t < t_{\Delta 2}$, $I_{\Delta} < I_{\Delta 3}$;

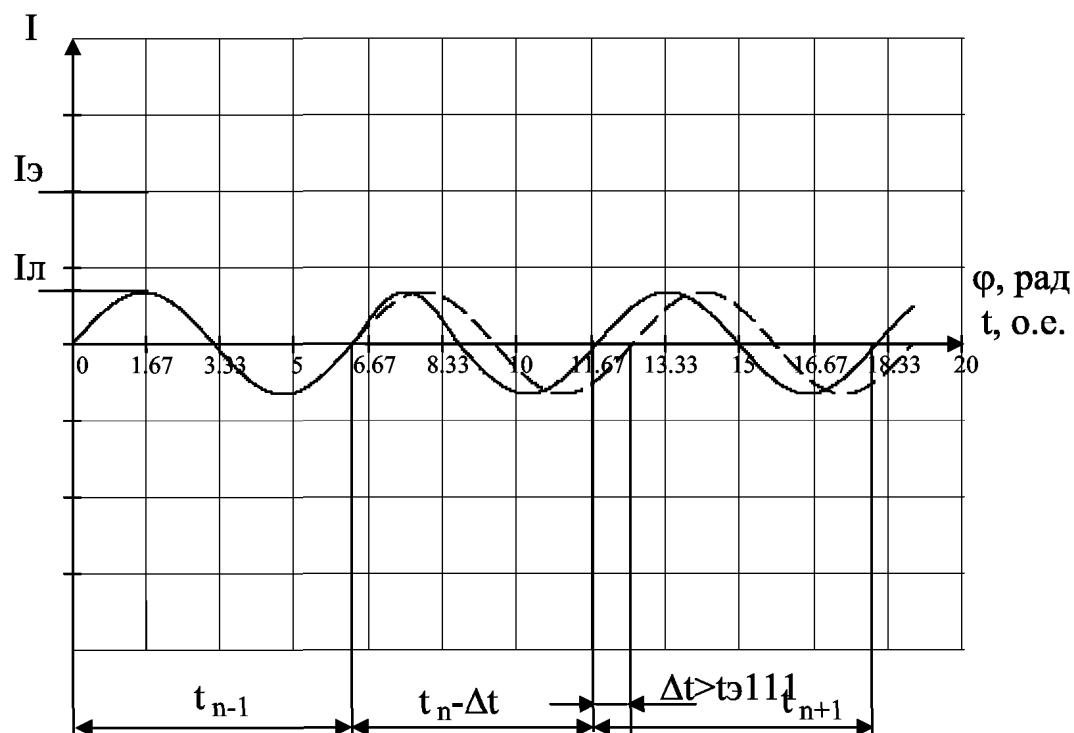


Fig. 3: Diagram of operating conditions with the big increment of a corner of loading

c) Mode of short circuit in a protection operating range, with the big increment of a corner (fig. 4). In this case the time equivalent of a corner more than the first and less than the second angular reference parameter, simultaneously a current exceeds reference parameter of a current - the operation condition is carried out, protection disconnects of transmission line: $\Delta t > t_{01}$, $\Delta t < t_{02}$, $I > I_{03}$;

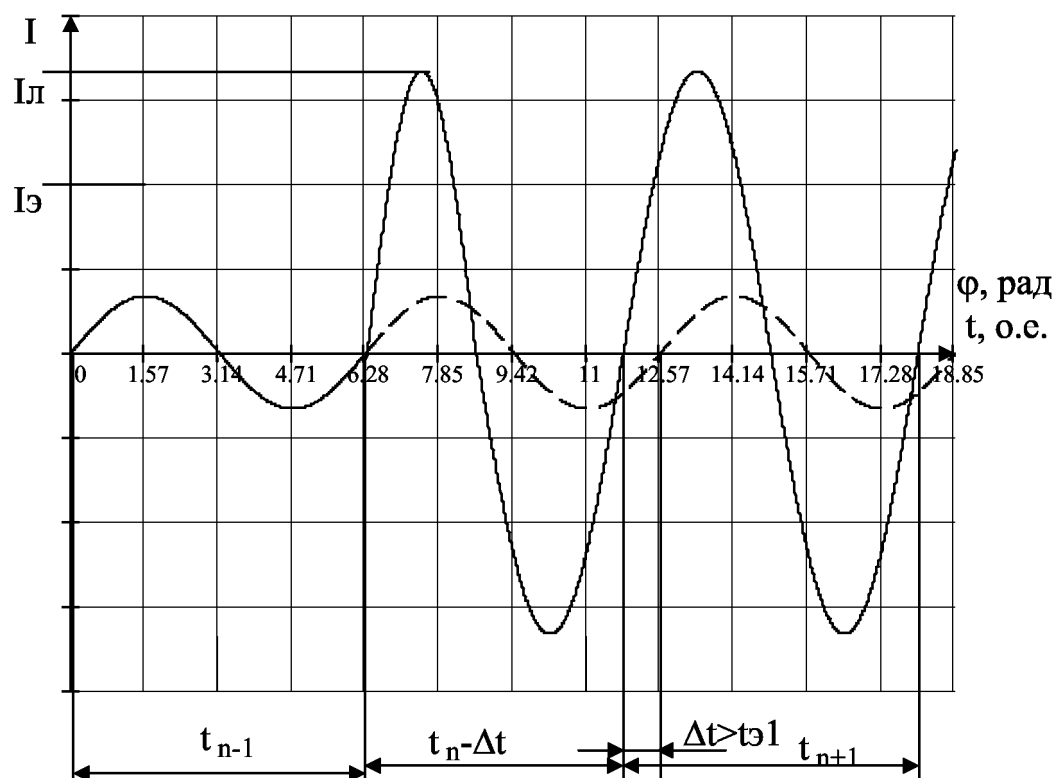


Fig. 4: Mode Diagram of short circuit with a protection operating range, with the big increment of a corner

d) Mode of short circuit out with an exception of a protection operating, with the big increment of a time's equivalent of a corner (**fig. 5**). It is emergency mode which can arise, for example, at short circuit "behind the back" protection, on adjacent of transmission line. In this case the current exceeds reference size of a current, and an increment of a time equivalent of a corner more than angular reference sizes (this condition of failure), therefore protection of transmission line doesn't work:
 $\Delta t > t_{\Sigma 1}, \Delta t > t_{\Sigma 2}, I_{\Pi} > I_{\Sigma 3}$

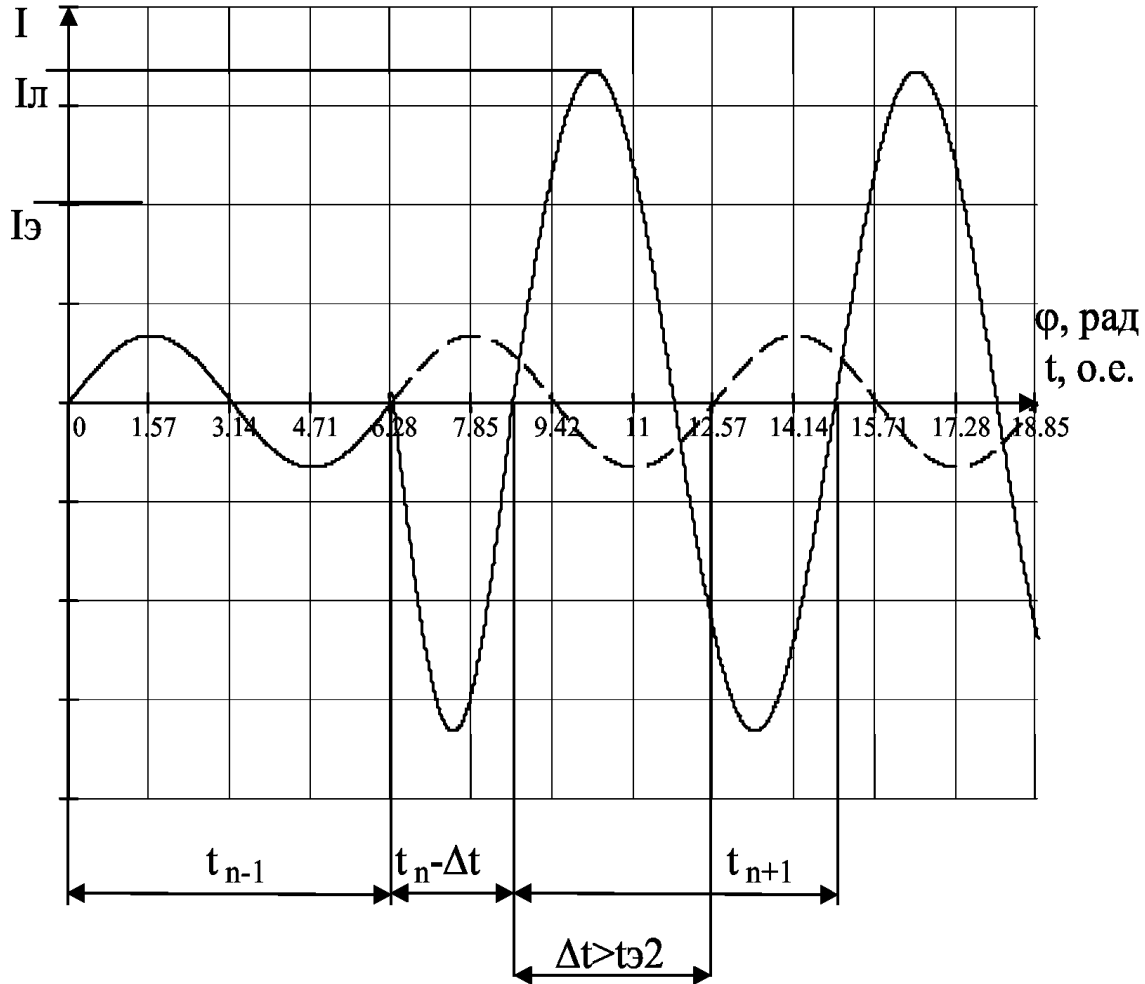


Fig. 5: Diagram of short circuit mode with an exception of a protection operating range, with the big increment of a time's equivalent of a corner

2.3 Algorithm realization

On **fig. 6** the device block diagram токовой the directed protection with one entrance parameter is presented. Where it is designated Q - the switch of a protected line w ; TA - the transformer of a current of a line; ПТ - the current converter; YJ3 - an controlled delay line; K - the proof-reader of duration of the period of industrial frequency of a line of a delay; КП1 and КП2 - the transition comparator current a signal from a positive half wave in negative (the comparator of transition of a signal of a current through zero); ГИ - the generator of impulses; C1 and C2 - counters of impulses; CC1, CC2 - comparison schemes on a phase; CC3 - the comparison scheme on amplitude, $\Sigma 1$, $\Sigma 2$ and $\Sigma 3$ - the first and second reference parameter of an angular equivalent and reference parameter of a current, accordingly; OB1 and OB2 - one-vibrators (dilator of impulses); 3B - an element of a delay of time, И - the logic scheme "AND".

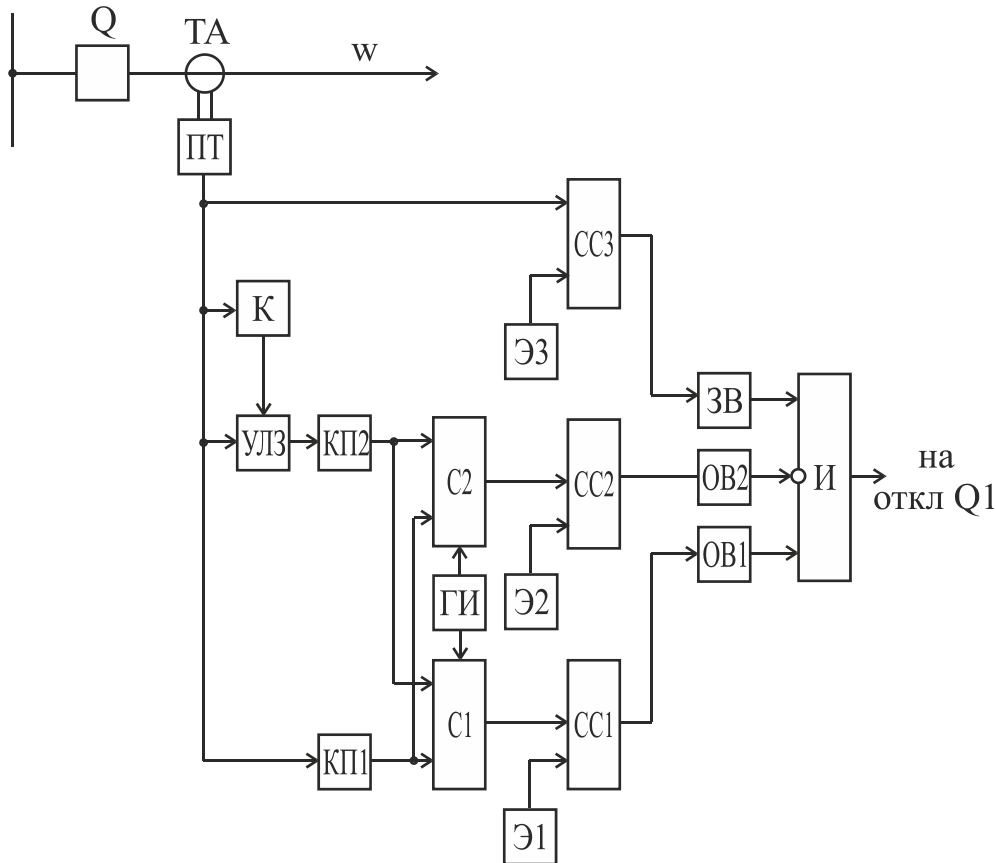


Fig. 6: Device block diagram current's the directed protection with one entrance parameter

The device works as follows. For protection operation it is necessary performance of three conditions: excess of a current volume, excess of the first parameter of a phase of a current and excess of the second parameter of a phase of a current. These three conditions should be executed on a logic element "AND".

1) The signal of a current from a line w passes through the transformer of a current TA and the converter of current ПТ arrives in the scheme of comparison CC3, where the size of current I_L is compared to reference size (standard of current I_{33}) from Э3. At excess of a current of a line $I_L > I_{33}$, necessary for protection operation is satisfied. The signal from CC3 arrives on an element of a delay of time 3B on which it is exposed standard on time, connected with excess from self-start t_{C3H} .

2) The signal of a current from a line w through the transformer of a current TA and the converter of current ПТ arrives in comparator КП1 which develops an impulse at transition of a signal of a current through zero from a positive half wave in the negative. On similar comparator КП2 the current signal arrives from ПТ through an operated line of delay YJ3 which makes a delay of a signal of a current on duration of the period ($t=0,02$ s) industrial frequency ($f=50$ Hz). As working frequency in system (so also duration of the period) can slightly change in admissible limits 49,8 ... 50,2 Hz duration of delay YJ3 is corrected by the special proof-reader K according to changeable frequency. The first counter C1 is started by an impulse from comparator K2, and stops an impulse from comparator K1. If during the previous period there was a change of a phase of a current in this time counter C1 will count quantity of the impulses submitted from the generator of impulses ГИ. The quantity of the counted impulses will be proportional Δt - the first volume of an angular equivalent. Standard on a phase it is exposed on the first reference volume Э1 of an angular equivalent. If the phase changes on size more standard t_{31} (that probably at short circuit in protection operative ranges in point K1, **fig. 1**) condition $\Delta t > t_{31}$ will be satisfied and the scheme of comparison CC1 gives out an impulse at least during duration of the period of industrial frequency. Thanks to one-vibrators (dilator of impulses) ОБ1 this impulse is present on it during time $t_{OB1} = t_{C3H} + t_{3AH}$, where t_{3AH} - time of a stock necessary for reliable operation of switch Q.

3) If the current phase for the measured period changes more admissible (that probably at short circuit out of a protection operating range in point K2, **fig. 1**) condition $\Delta t > t_{32}$ will be satisfied and the scheme of comparison CC1 gives out an impulse at least during duration of the period of industrial frequency. Thanks to one-vibrator (dilator of impulses) OB2 this impulse is present on it during time $t_{OB1} = t_{C3H} + t_{3AH}$, where t_{3AH} – time of a stock necessary for reliable failure of switch Q. As from exit OB2 the signal arrives on the inverted input of an element "AND" in this case the signal on switch Q switching-off won't occur.

Thus the device will give a signal on switch Q switching-off at observance of three conditions:

- if the line current exceeds standard of current $I_{Л} > I_{33}$;
- if the phase of a current of a line increases will exceed the first standard of phases $\Delta t > t_{31}$;
- if the phase of a current of a line doesn't exceed the second standard of phase $\Delta t < t_{32}$;

3 CONCLUSION

The current's protection constructed on offered algorithm react from short circuit in a protection operating range, don't work at short circuit out of an operative range of protection (at short circuit "behind the back" protection, on adjacent of transmission line) and at change of a direction of capacity in a line in operating conditions.

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