ELABORATION OF A HIGH-SPEED MICROPROCESSOR RELAY PROTECTION DEVICE

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Microprocessor relay protection devices (MP RPD) are an integral part of the automated control system (SCADA) of the electrical part of energy networks and systems, because they provide a high degree of informatization of electric power processes. MP RPD are intelligent systems with the ability to be improved by changing software and using more advanced principles and algorithms for the protection. Such algorithms are signal filtering algorithms that are difficult to implement due to the large volume of operations for processing the input signal.
An effective algorithm for extracting symmetrical components for MP RPD was developed. The filtration of symmetrical components is based on well-known relationships, which are generally presented as follows:

$$3\overline{A}\,0 = \overline{A} + \overline{B} + \overline{C},\quad 3\overline{A}1 = \overline{A} + \underline{a}\,\overline{B} + \underline{a}^{*}\overline{C},\quad 3\overline{A}2 = \overline{A} + \underline{a}^{*}\overline{B} + \underline{a}\,\overline{C}, \qquad (1)$$

where $\underline{a}$ is a phase operator; A, B, C is a 3-phase system of values of currents and voltages; A0, A1 and A2 are zero, forward and reverse sequences.

The existing relay protection and automation equipment mainly analyze only currents and voltages of the zero sequence A0, while more than 50% of the accidents occur during 2 and 3 phase failures, which require analysis of the values of currents and voltages of the negative sequence A2 [2].

Therefore, the urgent task is to develop effective algorithms for calculating A2, providing high speed and accuracy when using industrial microcontrollers. For A2 calculations, it is proposed the following expression:

$$3X2i = 3 * (Xci - Xbi) + Xa(i\text{-}30^{\circ}) + Xb(i\text{-}30^{\circ}) - 2 * Xc(i\text{-}30^{\circ}), \qquad (2)$$

where ***Xci, Xbi*** is the instantaneous value of the current (voltage) of phase ***c*** and phase ***b***;
Xa (i-30°), Xb (i-30°), Xc (i-30°) - instantaneous value of current (voltage) of phase ***a,b.c*** of 1/12 of the period back;

The proposed algorithm for A2 calculating was implemented in MP RZA LIRA (Local measuring and recording device). The following results were obtained: the error in measuring of currents and voltages amplitudes of zero A0 and inverse sequences of A2 was no more than 2%, speed - not less than 0.8 ms, that shows the effectiveness of the proposed algorithm. The pilot operation at MOLDELECTRICA confirmed the efficiency of the use of the developed devices.

Keywords: *high speed algorithm, microprocessor, relay protection, symmetric digital filters.*

References

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