PERFORMANCE EVALUATION OF TWO TYPE OF NUMERICAL DISTANCE RELAYS UNDER FAULT TRANSIENTS

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Résumé

Dans le présent article on envisage une protection de distance basée sur le dialogue de deux protections utilisant la technologie numérique du relais 7SA612 et REL316*4 qui constitue un moyen performant en terme de rapidité et de sélectivité pour l'élimination des défauts ligne(s) et barres de poste(s) de raccordement .Comme elle peut assurer un secours "éloigné" dans de bonnes conditions. Ceci permettra d'avoir en permanence deux protections de distance numérique pour surveiller la production décentralisée connectée à travers une ligne HT. Plusieurs résultats de simulations sont donnés pour conformer cela.

Mots clés *: Production Décentralisée, Raccordement au réseau HT, Protection de distance, Relais de distance numérique, SIPROTEC 7SA612,ABB REL316*4.*

Abstract

In this paper one considers a numerical distance protection based on the dialogue of two protections using the numerical technology of relay 7SA612 and REL316*4, which constitutes a powerful means in term of speed and of selectivity for the elimination of the lines and bars faults in connecting stations, it can also ensure a " distant " help under good conditions. This will make it possible to have permanently two protections of numerical distance to supervise the decentralized production connected through a HV line. Some simulation results are given to confirm that.

Keywords *: Decentralized production, connection with the network HV, distance protection, numerical distance relay, SIPROTEC 7SA612, ABB REL316*4.*

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ملخص

في هدا المقال نتأمل وقاية حسابية عن بعد مرتكنة على حوار واقيتين تستعمل التكنولوجيا الحسابية للتتابع7SA612 وREL316*4 : الذي يكون وسيلة قوية من حيث السرعة والاختيار من اجل حذف الخلل في الخطوط و القضبان في محطات الربط . يمكن كذلك أن تؤمن المساعدة عن بعد تحت شروط جيدة . هدا يجعل من الممكن الحصول بشكل دائم على وقايتين حسابيتين عن بعد للإشراف على الإنتاج اللامركزي موصلة عبر خط الإجهاد العالي(HV) . بعض النتائج المحاكاتية معطاة للتأكيد دلك.

الكلمات المفتاحية: *إنتاج لامركزي. الربط بالشبكة* ، (HV) ،. وقاية عن بعد ، تتابع حسابي عن بعد ، SIPROTEC 7SA612. ABB REL 316*4

The distance protection is the type of protection generally used on networks HV (High Voltage) of the aerial type. Requiring only local measurements (current and phase tension), and having a device of anti pumping (so as not to be sensitive to the situations of oscillations of power), it constitutes a powerful means in term of speed and selectivity for the elimination of the lines and bars faults in connection stations.

Its operating time is in theory compatible with times of elimination (time of opening circuit breakers included) pertaining to Intervals 250-500 ms (in 225 kV) and 250-850 ms (in 63-90 kV), which are usually necessary. Finally it can ensure a "distant" help under good conditions. Current numerical technology enables them to have interesting complementary functions (not very active source, Fault recording...).

Several authors e.g. [1] , [2] lent much attention to the study of the transmission lines protection, choosing a suitable relay type .Other authors [3], [4]and [5] studied the modelling and testing of various numerical distance relays with only one reeclenchor

For the design and coordination of protective relays in a network, the most important rule is the redundancy: A protection system has to care for redundant function of relays in order to improve reliability. Redundant functionalities are planed and referred to as backup protection. Moreover, redundancy is reached by combining different protection principles.

The proposed method in this paper, is based to ensure an adequate and effective protection of a decentralized production connected to a HV 220 kV.

This new approach which uses impedance relays of type: 7SA612 in parallel with REL316*4, is based on a dialogue between two numerical distance protections, which are placed in the two ends of the line. Each one is equipped with its own numerical reeclenchor.

This constitutes an increasing powerful means in term of speed and of selectivity for the elimination of the lines and bars faults in connecting stations.

1. THE PROBLEMATIC OF HV NETWORK PROTECTION

The groups of decentralized production connected in HV (networks 63 - 90 and 225 kV) take part, when they are started, in the fending the faults affecting the connection works (lines, buried cables, stations). It belongs with:

- the owner of the network to define the expression of its needs as a person in charge for the exploitation of HV networks,
- the producer to satisfy these needs by the setting in work of the adequate means as a person in charge for the disturbances (feeding of insulation defects) affecting connect HV networks.

1.1 Expression of the needs

The expression of the needs is established [6] on the basis of the protection plan of the networks concerned (225 kV or HV) and according to the mode of connection which is determining (nature of the level of tension, nature of the works air lines, underground connections , direct connection on the sets of bars of a station...).

It requires achieving a status in relation to:

- Protection systems of the various works of the concerned network and associated performances,
- Level of quality of supply (in term of long, short, very short cuts, of hollows of tension and disturbances and pollution of the tension wave) in particular object of contractualisation with customers served by the connection stations or the framing stations.

It rests on the principle that the connection of the means of decentralized production should not degrade the performances of operation of HV networks and the quality of supply to the customers and must allow their improvement similar in time that there would be in its absence.

It must comprise, in the respect of the protection plan, the following needs as regards performances of the protection system to be implemented by the producer:

1.1.1. Speed of elimination

- Maximum times of elimination of the faults on the connections point to the GFS (**G**eneral **F**eeder **S**ystem), and on the station bars of connecting to the GFS.

1.1.2. Selectivity

(Emission by the protection system of tripping orders of only circuit breakers delimiting the work at defect).

- Identification of the works and the switchgear concerned,
- In the case of connection by an aerial line with 225 kV, elimination in the event of Single Line Ground fault (SLG) which is not resistant by opening only the phase at fault (this provision being systematically carried out on the network 225 kV of the GFS.

This need is based on the research of the best availability as regards evacuation of energy insofar as the producer accepts it and where the groups admit it technically (stability).

- Possibly, a minimal time of elimination of the faults on the connection point to the GFS, or on the bars of the connection station of to the GFS, in certain particular situations.

1.1.3. Safety of the people and the goods

(Standard ISO 8402, " risk of physical injuries limited to an acceptable level").

- Existence, within the protection system, of equipment ensuring a "distant" help allowing elimination of a fault affecting another work other than the work of connection, in an acceptable time in the event of failure and whatever is its origin (resistant fault, measurement reducing damages, defect of common mode...).

2.1.4 Reliability

- Selective principal protections doubled except in absence of need (a very weak probability of faults in the point of connection as a guarantee of ensuring high quality a preventive maintenance constituting significant elements so as not to resort to it). This applies to connections in 225 kV or 63-90 kV in certain cases (stations F and certain stations S or from star shaped of high level of quality).
- Treatment of the "failure circuit breaker" (with the opening excited by a protection) in the case of a direct connection on a HV station of the GFS (without point of connection equipped with circuit breakers); It is about the taking into account by the producer of an action of instantaneous decoupling of its installations, following detection by the network owner of the failure of one of the switchgear belonging to its station (on the assumption that this station is equipped with the function " failure circuit breaker").

2. DISTANCE PROTECTION

This protection is the equipment the most used in the world [7] on all HV networks of aerial type, (in particular because of its total autonomy which does not require any connection between two ends of the line to be protected); it is characterized by two things:

a) The relation between the distance from the defect and the time of release of the relay,

b) The electric quantities which make it possible to measure the fault distance.

Distance protection is selective, insensitive to external faults, to operation outside network synchronism and to the variations of the tension; it can be used on lines the length of which ranges from 10 to 300 km and whose service tensions are higher than 30 kV. These protections using elaborate local criteria starting from the measurement of the currents and/or tensions at the level of each departure [8]: These are distance protections which allow to locate the site of the fault by measurement of the impedance between the departure measurement reducers, which deliver the reference electric quantities, and the point of defect.

The principle of distance protection is based on the Ohm's law:

Knowing that: $U = Z_L * I$ (1)

with: $Z_L = R_L + j X_L$ (2)

In the case of fault; current I increases, the tension U decreases with the result that the impedance of line Z_L varies. It is noticed that the impedance of line (Z_L is proportional to the length L, therefore to determine the length where the problem occurs, it is sufficient to know the impedance i.e. the image of the tension and current from the potential (voltage) transformer PT and current transformer CT. The line to be protected must be divided by three downstream zones and one upstream zone (figure1) :

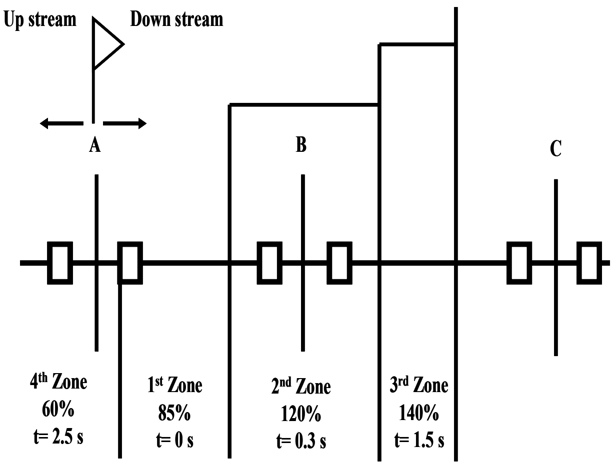


Figure 1 : General diagram of the selection zones of measurement

- The first zone covers 85% of the line; and release is instantaneous t = 0s.
- The second zone temporised is intended to protect
- 15 % of the remaining line, and extends + 20% from
- the adjacent line shortest, and started the circuit
- breaker in t = 0,3s
- The third zone is a release in help and should cover 20 % of the lines leading to the following points, to mitigate to a failure of to their own protections, temporization is regulated at t = 1,5s.
- The fourth zone temporized at t = 2,5s, it covers 60 % of the upstream line

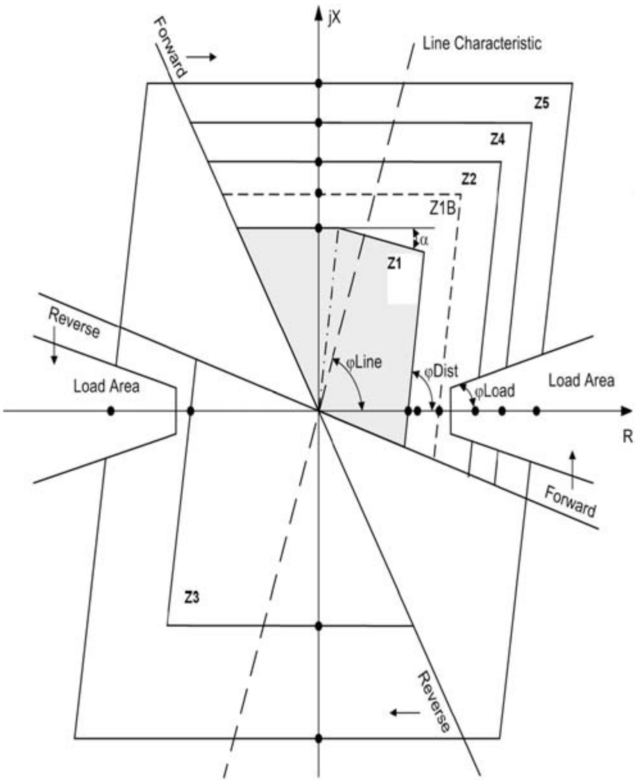


Figure 2 : Quadrilateral tripping characteristic of distance relay (setting values are marked by dots)

The distance protection has a quadrilateral tripping characteristic(figure 2). Depending on which version was ordered, a circular tripping characteristic can be set. If only the circle tripping characteristic is required [7].

It is necessary particularly to announce the advantage offered by using the polygonal characteristics when it is a question of protecting the long and very charged lines.

Various types of relay of distance measurement used in the world are :

a) - Electromechanical relays.
b) - Static relays.
c) - Numerical relays.

The first two types are not used any more following the appearance of the numerical relays which are more powerful.

2.1 Numerical relays

Numerical technology made its appearance at the beginning of the years 1980. With the development of the microprocessors and memories, the numerical chips were integrated into the protection equipments.

The numerical protections are based on the principle of the transformation of electric variables of the network, provided by measuring transformers into weak voltage numerical signals. The use of treatment digital techniques allows to break up the signal into vectors which authorizes a data processing via protection algorithms according to the desired protection. Moreover, they are equipped with a liquid crystal screen on the front face for local operation.

These devices require an auxiliary source offer an excellent level of precision and a high level of sensitivity. They get new possibilities, like:

- Integration of several functions to fulfil a protection function, complete in the same unit,
- Processing and the storage of data,
- The recording of the disturbances of the network (Fault recording),
- The diagnosis of the connected devices (circuit breakers etc.).

These models integrate auto testing possibilities which increase their continuity of operation while reducing the duration and the frequency of the maintenance operations. In addition to the protection functions, this equipment also has complementary functions facilitating their operation.

The connection series make it possible to parameterize them in a microcomputer and to connect them to a control system at the local and central level. They also make it possible to profit from recent discoveries in the field of artificial intelligence, like the neural networks and fuzzy logic.

Example : 7SA 511, 7SA 612, D60, REL 314 etc.

The functions of protection are fulfilled by multifunction relays or apparatuses. At the origin, the relays of protection were of analogical type and generally carried out only one function.

Currently, numerical technology is the most employed. It makes it possible to conceive increasingly advanced functions and the same apparatus generally fulfils several functions. This is why one rather speaks about multifunction apparatuses

3. SIPROTEC 7 SA 612

SIPROTEC 7SA612 [10], [11] is an impedance (distance) relay for the lines of transmission of energy. This relay ensures all the range of distance protection and has the whole of the protection functions normally necessary to the protection of a power line.

The relay is used for the fast and selective release for defects in the span and transmission cables and the aerial lines with or without lines of compensation of series condensers. The neutral point of the network can be solid or put in the ground (resistance against ground), put in the ground by inductive way via Peterson reel or insulated. It is adapted for the single line -to- ground and three-phase release applications with and without curves of distance protection.

The numerical distance protection SIPROTEC 7SA612 is equipped with a powerful microprocessor system. This provides fully numerical processing of all functions in the device, from the acquisition of the measured values up to the output commands to the circuit breakers.Figure 3 shows the basic structure of the 7SA612.

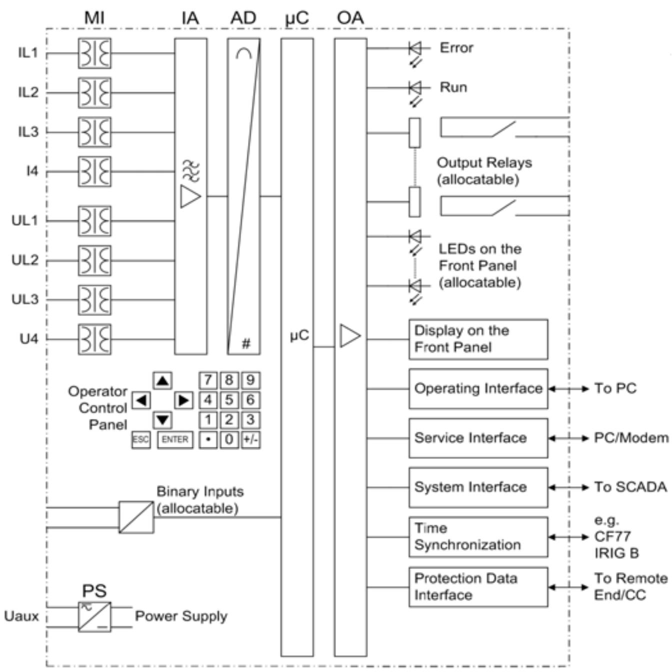


Figure 3 : Hardware structure of the digital distance protection 7SA612

The measuring inputs (MI) transform the currents and voltages derived from the instrument transformers and match them to the internal signal levels for processing in the device. The device has four current and four voltage inputs. Three current inputs are provided for measurement of the phase currents, a further measuring input (I4) may be configured to measure the earth current (residual current from the current transformer star-point), the earth current of a parallel line (for parallel line compensation) or the star-point current of a power transformer (for earth fault direction determination).

4. REL316 * 4 of ABB

The fully numerical protection terminal REL316*4 is a compact line terminal [12]. It is designed to provide high-speed selective protection in distribution, MV and HV transmission systems. It can be applied at all power system voltages and in solidly earthed, low impedance grounded or ungrounded systems or in systems equipped with arc suppression (Petersen) coils.

REL316*4 can be used on overhead lines and cables, long feeders, short feeders, parallel circuit lines, heavily loaded lines, lines with weak in feeds and on "short zone" lines.

It detects all kinds of faults including close three-phase faults, cross-country faults, evolving faults and high-resistance ground faults.

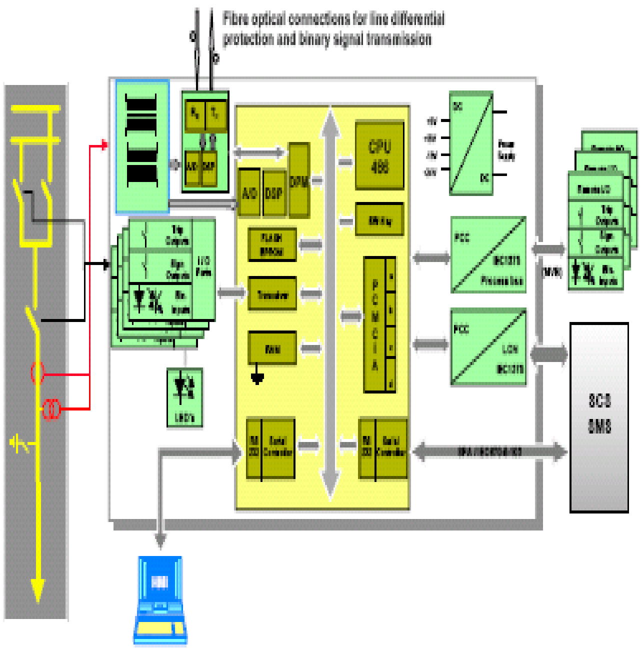


Figure 4 : Hardware platform overview (REL.316*4)

The hardware concept for the REL316*4 line protection equipment comprises four different plug-in units, a connecting mother PCB and housing (Figure 4) :

- analog input unit
- central processing unit
- 1 to 4 binary input/output units
- power supply unit
- connecting mother PCB
- housing with connection terminals.

The numerical distance protection REL316 * 4 of ABB is equipped with a powerful microprocessor-based system. All the operations carried out by this apparatus, such as the acquisition of the measurement values and the emission of the orders intended for the circuit breakers and other high voltage equipment are treated in a completely numerical way figure 4.

5. MATHEMATICAL MODEL OF THE STUDIES LINE

It is a question of ensuring an adequate and effective protection [13], [14] of a Decentralized Production **DP** connected to HVB 220 kV bars. This protection is given in Figure 5 is based on a dialogue between two numerical distance protections by different manufacturers; each one equipped with its 7SA612 reeclenchor (of family 7SA by Siemens) and REL316 * 4 (of family REL of ABB) so as to mitigate to rare dysfunctions, but nevertheless existing

5.1 Role of two protections

Numerical distance protections are intended to ensure the selectivity of the neutral networks connected directly to the ground.

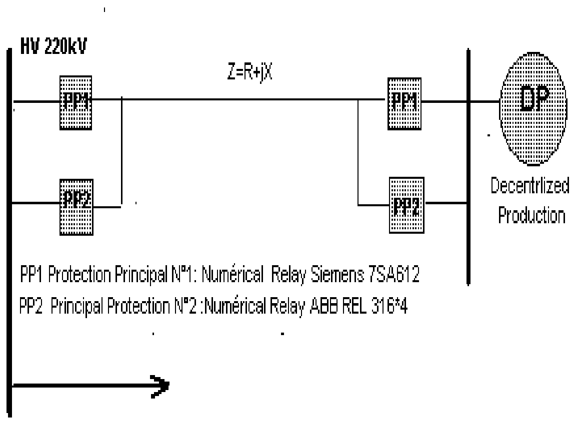


Figure 5 : Model of the studied line: A Decentralized Production connected to HV 220 kV bar

These protections offer characteristics especially adapted to lines of any type long, average or short, a fast time of release whatever the position of the fault with respect to the supervised distance limit.

5.1.1. Data of studied line

Nominal voltage: U = 220 kV (line-line)

Nominal frequency: $f = 50$ Hz

Length of the line: L = 51,6 km

Resistance of the direct line $R_1 = 0,12\ \Omega/km$

Reactance of the direct line $X_1 = Lw = 0,42\ \Omega/km$,

Capacitive reactance of the line: 1/cw is neglected because the length line is short.

Impedance of the line :

$Z_L = R_L + jX_L = 0,12 + J0,42\ \ \Omega/km$

Module of $Z_L = 0,43680\ \Omega/km$

The angle of the line ϑ_L= Arc tg (X_L/R_L) = 74,0546°
The section of conductor : S = 256 mm^2
Type of line conductor is ALMELEC
Pylon resistance: R_{pyl} = 25 Ω
Arc resistance : R_{arc}= 6 Ω for the L-L faults
Arc resistance : R_{arc} = 9 Ω for S.L.G fault
For these resistance R_{arc} and R_{pyl} : they are measured values.

5.2. Data of measurement transformer

k_{PT} = 220 000 V / $\sqrt{3}$ / 100 V / $\sqrt{3}$ = 2200
k_{CT} = 1600 A / 1A = 1600
$k_Z = k_{PT}$ / k_{CT} = 2200 / 1600 = 1,3750
Complex factors of ground impedance:
k_o = 1/3 [(Z_o / Z_1) - 1] = 0,6666

These data are necessary to calculate the zones of measurements of the two distance protections PP1 and PP2.

5.3. Programming of principal protection PP1 and PP2

To be able to program and communicate with protection PP1 7SA612, one uses software DIGSI 4.7 by SIEMENS (is a graphic tool to manage components within SIEMENS protection systems) Thereafter software SIGRA 4 assists you to exploit defects recordings.

The programming and the communication with PP2 are through the software, CAP2/316 of ABB. The CAP2 is software used to program protection REL 316*4 ABB.

Functions to be programmed :
- Distance Protection (excitation by minimum of impedance).
- Fault locator.
- Detection pumping.
- Automatic re-engagement
- User switching functions.
- Ground faults protection with neutral put at the ground.

5.3.1. Determination of the various measurement zone

X_{HT} = X * l = 0, 42 * 51,6 = 21,672 Ω
R_{HT} = R * l = 0, 12 * 51,6 = 6,192 Ω
X_{BT} = X_{HT} / k_Z = 21,672 / 1,375 = 15,7614 Ω
R_{BT} = R_{HT} / k_Z = 6,192 / 1,375 = 4,5033 Ω

5.3.2 The starting zone (starting)

X + A (reactance of starting downstream).
X + A = X_{BT} * 140% = 15, 7614 * 1.4=22.0660 Ω
X – A (reactance of starting upstream).
X – A = X_{BT} * 60% = 15,7614*0.6 = 9,4568 Ω .

5.3.3. Programming measurement zones

The calculations of measurements zones previously done are summarized in Table 1:

Table 1 : Programming of the zones of measurements 7SA612 and REL316*4

	Z_1 (Ω) down stream zone	Z_2 (Ω) down stream zone	Z_3 (Ω) down stream zone	Z_4 (Ω) up stream zone
Resistance RR (n)	9,8278	11,4040	12,3046	8,7020
Reactance	13,3972	18,9137	22,0660	9,4568
Résistance RRE (n)	37,8278	39,4040	40,3046	36,7020
Temporization	0	0,3	1,5	2,5

such as:

RR (n) = R_{BT} + R_{arc}
RRE (n) = R_{BT} + R_{arc} + R_{pyl}
RR(n) : Range in resistance (including the arc resistance) for the zone (n) in the presence of a LL,(or DLG,LLL) faults, this parameter must have the same sign as X(n).
RRE (n) : Range in resistance (including the arc resistance) for zone (n).

5.3.4. Inter protection dialogue of 7SA612 and REL316*4

The inter protection dialogue is represented by the diagram given in figure 6. With the appearance of a fault, the two principal protections 7SA612 and the REL316*4 which function in competition, the fastest reacts and starts the circuit breaker with the reenclenchor of principal protection PP1 (7SA612).

If a single line ground fault (SLG) which appears in first or second zone, this causes the starting of the reenclenchor of principal protection PP1 even if the principal protection PP2 (REL316*4) which functioned; It opens the phase at defect by the reenclenchor of principal protection PP1, through binary exits of principal protection PP2, which are :
- Dd 28 startup,
- Dd 32 phase 1 out for automatic switching on,
- Bd 28 phase 2 out for automatic switching on,
- Data base 32 phase 3 out for automatic switching on,

their turn the binary entries of principal protection PP1 attack these are :
- J9, J1, P17 and N1 constituting a 2nd switching on automatism.

If the reenclenchor of principal protection PP1 does not function, a binary exit P9 (relay in order) of principal protection PP1 starts the reenclenchor of principal protection PP2 via a binary entry Az8 (blocking), therefore the two protections function with the reenclenchor of principal protection PP2

For the line-line or three-phase faults the two protections open directly the circuit breaker in three-phase (final release) and block the reenclenchor in service.

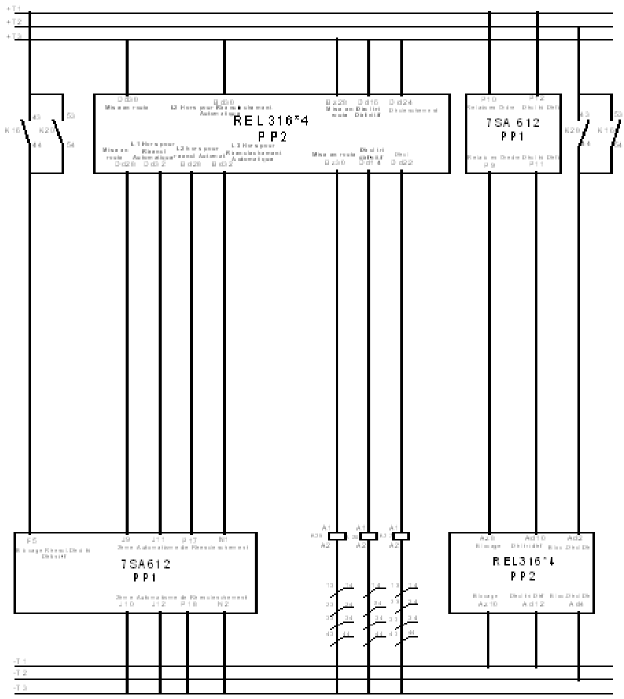


Figure 6 : Diagram of dialogue inter protection 7SA612 and REL 316*4

6. SIMULATION RESULTS

6.1. Utility of the test

The utility of the test is to see the dialogue inter protections, the speed of release and the difference between the real time of release and theoretical time.

6.2. Materials used

The tests are carried out with the assistance of:

- The case of injection CMC256 of OMICRON.
- Microcomputer (PC Pentium IV 3Ghz).
- Two numerical distance protections PP1 (7SA612) and PP 2 (REL316*4)

The standard case of injection (CMC 256) manufactured by OMICRON[11], the CMC 256 is part of a test system, it is designed for testing protection and measurement apparatuses, in the public services as in the manufacturers; It is controlled by microcomputer, allows operation control and the start-up control of characteristics, and the release of the various safety devices.

CMC 256 offers a total flexibility and adaptability for the various applications tests.

6.3. Component of the system

- CMC 256 with electric cable (sector).
- Connecting cable CMC 256 with PC (provided).
- Connecting cable CMC 256 with the equipment to be tested

After having programmed and charged the adjustments in the two protections 7SA612 (using a DIGSI V4.6 software) and REL316*4 (using a CAP.RE.216..RE.316 * 4 software)and one microcomputer; We have create three files named (Simulation 1) for 7SA612 , (Simulation 2) for REL 316*4 and (Simulation 3)for both two protections, using a OMICRON software Test univers 2.0 from the numerical injection case .

6.4. Simulation 1: for protection PP1: 7SA612

One injects a single line-to-ground fault (SLG)

One injects a single line -to- ground fault, PP1 is faster than PP2 and its reenclenchor is in order; it managed the tripping orders; the reset was carried out with its own reenclenchor.

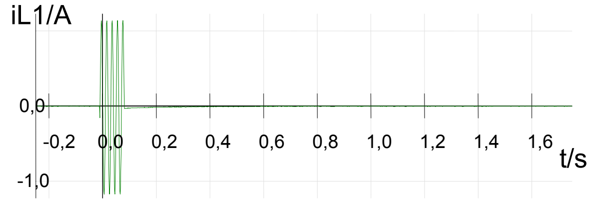
Release of PP1 and reset with its own reenclenchor:

The curves obtained are given in Figure 7:

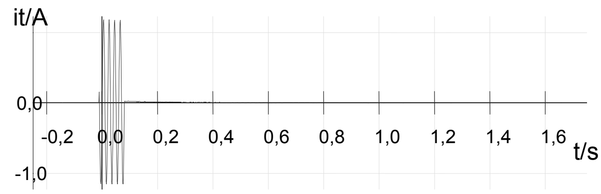
Comment :

Fault Recording :

- Appearance of the single line-to- ground fault (SL_1G) (figure 7.a/b).
- Drop voltage U_0 in the phase L_1 (figure 7.c)



(a)



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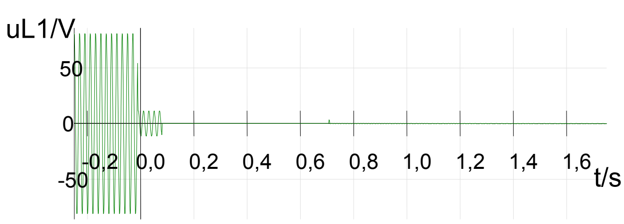


(c)

Figure 7 : Perturbographe of PP1 the 7SA612
(a) current in phase L_1 during the fault, (b) current in neutral, (c) tension in phase L_1.

Logical signals: (figure 8)

- Instantaneous starting L_1 and ground.
- Instantaneous starting of downstream protection of distances.
- General starting of the distance protection.
- Release L_1 after 3 periods (6ms).
- Total time of the elimination of the defect 4 periods (80ms)" time of response protection + time of opening of the circuit breaker ".
- Ordered reset L_1 after 1.3s (extinction time of the arc).

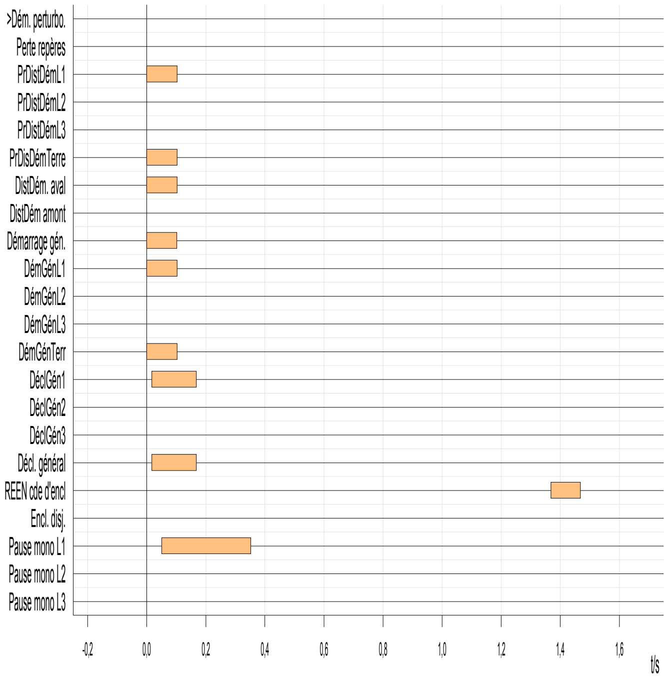


Figure 8 : Logical Signals of the 7SA.

6.5 Simulation 2: for protection PP2: RE.316*4

One injects a single line–to- ground fault (SLG)

One injects a single line-to- ground fault over the same phase L_1, this time it is PP2 which manages the tripping orders and rénclenchement.

Release of PP2 and reset with its own reenclenchor

The curves obtained are given in Figure 9:

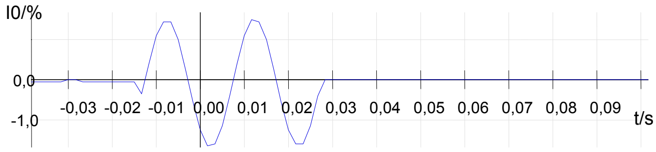
Comment:

Fault Recording :

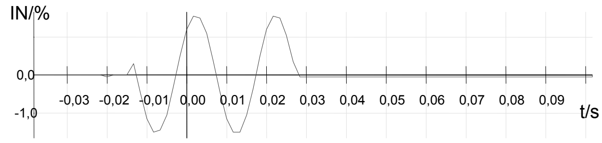
- Appearance of the single line-to-ground fault (SL_1G) (figure 9.a/b).
- Drop voltage U_0 in phase L_1 (figure 9.c).

Logical signals: (figure 10)

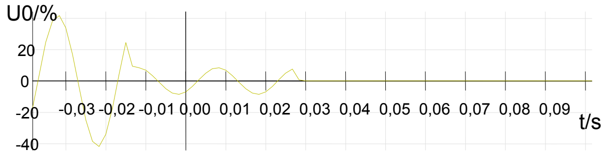
- General starting of the distance protection.
- General starting L_1 and ground.
- Release of circuit breaker afterwards.
- The elimination of the defect after " time of protection response + time of opening of the circuit breaker ".
- Ordered Reset after 1,3 ms (extinction time of the arc).



(a)



(b)



(c)

Figure 9 : Perturbography of PP2 the REL 316*4
(a) current in phase L_1 during the fault, (b) current in neutral, (c) tension in phase L_1.

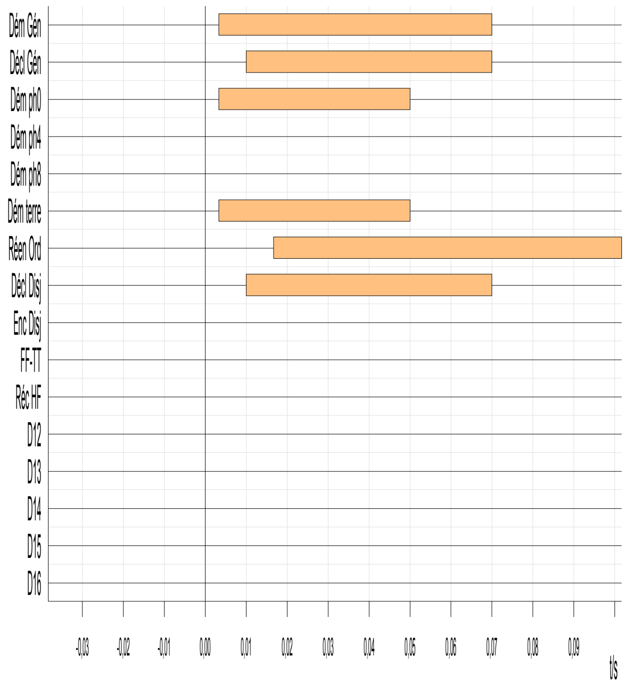


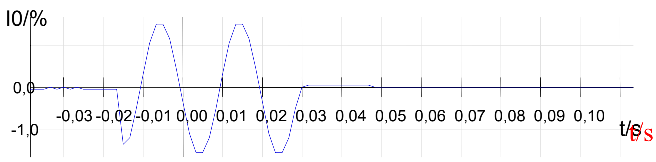
Figure 10 : Logical Signals of the REL 316*4.

6.6. Simulation N°3: for the two protections

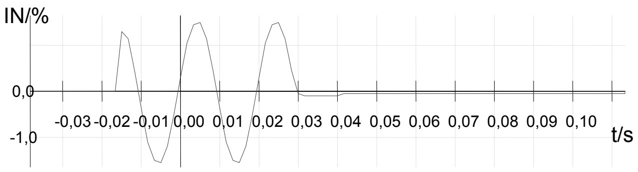
Release of PP2 and reset with the reenclenchor of PP1 :

To carry out this test, one increases the temporization of Z_1 of PP1 so that PP2 becomes faster than the PP1, always keeping ready the reenclenchor of this last. One injects a single-phase L1defect to the ground.

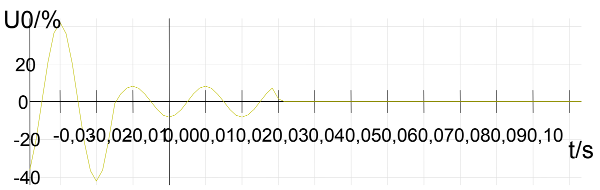
The curves obtained are given in Figure 11:



(a)



(b)



(c)

Figure 11 : Perturbography of PP2 ' REL',
(a) current in phase L_1 during the fault, (b) current in neutral, (c) tension in phase L_1

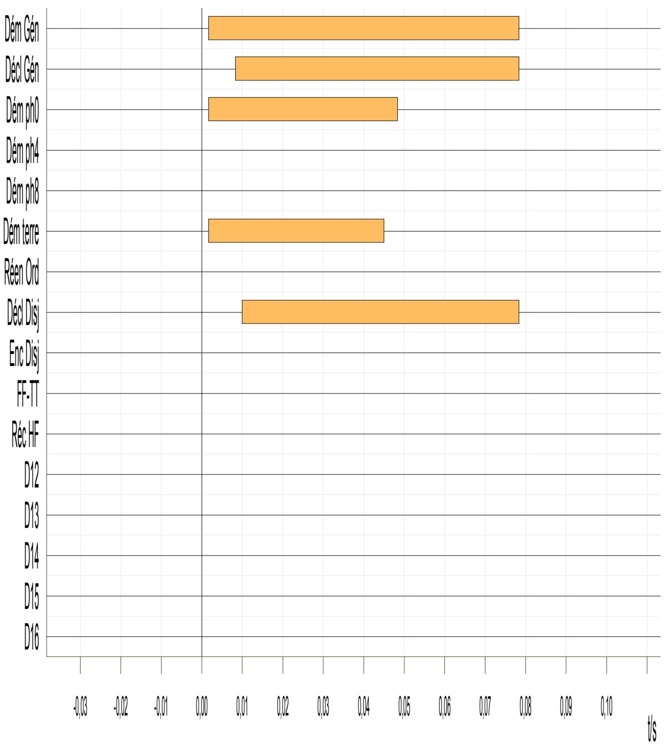


Figure 12 : Logical Signals of the REL.

Comment:

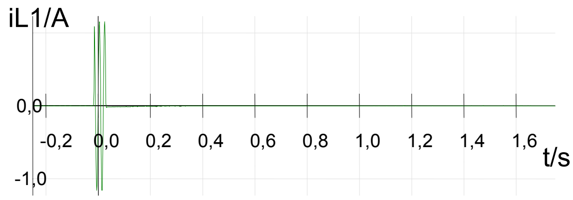
Fault Recording :

- Appearance of the single line-to-ground fault (SL_1G) (figure 11.a/b) .
- Drop voltage U_0 in phase L_1 (figure 11.c)

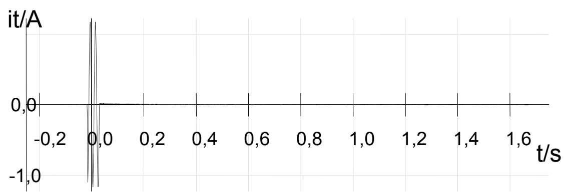
Logical signals: (figure 12)

- General starting of the distance protection.
- General starting of L_1 and ground.
- Tripping order.
- Circuit breaker release after 1ms.

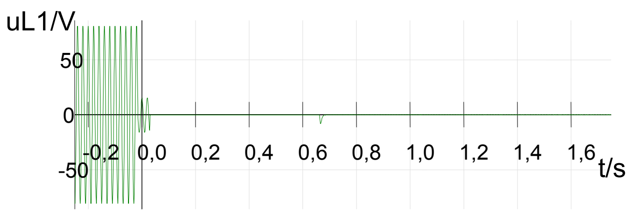
Since renclenchement was carried out with the PP1 renclenchor ; one also obtains the curves and the following PP1signals of (7SA612) in figure 13 and Figure14.



(a)



(b)



(c)

Figure 13 : Perturbography of PP1 ' 7SA',
(a) current in phase L_1 during the fault, (b) current in neutral, (c) tension in phase L_1

Comment:

Fault Recording :

- Appearance of the single line-to-ground fault (SL_1G) (figure 13.a/b).
- Drop voltage U_0 in phase L_1 (figure 13.c)

Logical signals: (figure 14)

- Instantaneous starting L1 and ground.
- Instantaneous starting of downstream distance protection.

Order of reset L_1 after 1.3s (extinction time of arc).coming from PP2

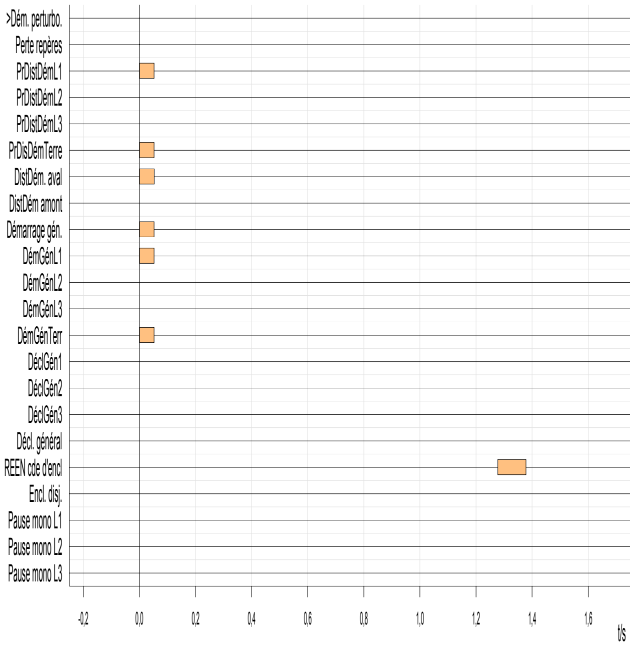


Figure 14 : Logical Signals of the 7SA.

7. DISCUSION

The passage from principal protection system and reserve protection, towards the principal protection system PP1 and principal protection PP2, in the new philosophy of the electricity companies offers several advantages in particular concerning the numerical technology of protections:

- Easy user interface.
- Programmable switching functions.
- The direct order of the couplings equipment.
- Adaptable external points of communication.
- A comfortable access with the programming software.
- A high reliability with very short elimination times of defect, and the adoption the reenclenchement cycle of whatever the protection which functioned.

CONCLUSION

In this paper we particularly interested in the study of the competitive operation of two numerical distance protections of 220kV the span line planned for the coupling of a dispersed production.

Competitive operation of family 7SA of SIEMENS and REL of ABB offers the best monitoring to this case of study.

After the realization of simulations one notes that: competition of two numerical protections (principal PP1 and principal PP2) offers not only the high reliability with very short fault eliminations times and the adoption of the reset cycle no matter which protection has functioned; but also an easy user interface, a comfortable access with the programming software.

The operating mode with the adoption of only one reenclenchor, this whatever the protection which starts, allows a better behaviour during appearance of evolutionary fault, fault which evolves from the single line ground to the line-line .

Lastly, as in any problem of interface, the quality and the perenniality of the installations will be at the same level of the quality step thus from reference frame agreed upon between the actors, in particular for the start up, exploitation and maintenance activities.

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