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# Analysis of fault using microcomputer protection by symmetrical component method

**Ashish Choubey[1], Latika Pande[2]**
Department of Electrical Engg. Jabalpur Engineering College, Jabalpur, M.P, India[1]
Research scholar of M.E (HVE) 4th sem[2]

## Abstract

***To enhance power supply reliability for the user terminals in the case of the distribution system to avoid interference by the fault again, rapidly complete the automatic identification, positioning, automatic fault isolation, network reconfiguration until the resumption of supply of non-fault section, a microprocessor-based relay protection device has developed. As the fault component theory is widely used in microcomputer protection, and fault component exists in the network of fault component, it is necessary to build up the fault component network when short circuit fault emerging and to draw the current and voltage component phasor diagram at fault point. In order to understand microcomputer protection based on the symmetrical component principle, we obtained the sequence current and sequence voltage according to the concept of symmetrical component. Distribution line directly to user-oriented power supply, the reliability of its operation determines the quality and level of electricity supply. In recent decades, because of the general power of the tireless efforts of scientists and technicians, relay protection technology and equipment application level has been greatly improved, but the current domestic production of computer hardware, protection devices are still outdated systems. Software development has maintenance difficulties and short survival time. With the factory automation system interface functions weak points, the network communication cannot meet the actual requirements. Protection principle configuration and device manufacturing process to be improved and so on.***

## Keywords

***Data Mining, Concept Lattice, Attribute Reduction, Close-degree, fault component, current and voltage***

## 1. Introduction

In many large-scale power plants, the structure of its auxiliary power system is complex, and the coordination of its relay protections is difficult. To enhance power supply reliability for the user terminals in the case of the distribution system to avoid interference by the fault again, rapidly complete the automatic identification, positioning, automatic fault isolation, and network reconfiguration until the resumption of supply of non-fault section, a microprocessor-based relay protection device has developed.[1] As the fault component theory is widely used in microcomputer protection, and fault component exists in the network of fault component, it is necessary to build up the fault component network when short circuit fault emerging and to draw the current and voltage component phasor diagram at fault point.[2] .We proposed a special phase sequence component based on the boundary condition. We analysis the velocity according to the relationship between analysis formula and phasor diagram and current in fault component boundary conditions and sequence voltage and current in boundary conditions. The negative and zero sequence component current and voltage at fault point are the same as fault component. The positive sequence component current and voltage at fault point are different from the fault component. So we consider the positive sequences according to that sequences we analyze the fault point.

To obtain the relationship between current and voltage fault component phasor diagram and according to the phasor sequences we obtain the graph to compare the boundary condition phenomena. To check the veracity of the analysis according to the relationship between analysis formula and phasor diagram of full voltage and current in fault component boundary conditions and sequence voltage and current in boundary condition

We also include short circuit current at fault point is the fault component one. The negative and zero sequence component current and voltage at fault point are the same as fault component ones. The positive sequence component current and voltage at fault point are different from the fault component ones which is also evaluated, when we analyze the fault component current and voltage, the positive, the negative and the zero sequence networks are all passive networks, which is regularized by the matlab coding.

## 2. Proposed Method

As the fault component theory is widely used in microcomputer protection, and fault component exists in the network of fault component, it is necessary to build up the fault component network when short circuit fault emerging and to draw the current and voltage component phasor diagram at fault point. We proposed a special phase sequence component based on the boundary condition. We analysis the velocity according to the relationship between analysis formula and phasor diagram and current in fault component boundary conditions and sequence voltage and current in boundary conditions. The negative and zero sequence component current and voltage at fault point are the same as fault component. The positive sequence component current and voltage at fault point are different from the fault component. So we consider the positive sequences according to that sequences we analyses the fault point.

**Steps:**

1. Obtain Boundary Conditions for Fault.
2. To obtain the special phase sequence component according to boundary conditions, then to draw fault component compound sequence network
3. To obtain the relationship between current and voltage fault component phasor diagram.
4. To check the veracity of the analysis according to the relationship between analysis formula and phasor diagram of full voltage and current in fault component boundary conditions and sequence voltage and current in boundary conditions.

Consider the positive values with the boundary conditions because they generate different fault point. Then apply the formula: The effect of an inductor in a circuit is to oppose changes in current through it by developing a voltage across it proportional to the rate of change of the current. An ideal inductor would offer no resistance to a constant direct current; however, only superconducting inductors have truly zero electrical resistance. The relationship between the time-varying voltage v(t) across an inductor with inductance L and the time-varying current i(t) passing through it is described by the differential equation:

$v(t) = L\, di(t)/dt$

When there is a sinusoidal alternating current (AC) through an inductor, a sinusoidal voltage is induced. The amplitude of the voltage is proportional to the product of the amplitude ($I_P$) of the current and the frequency (f) of the current.

$i(t) = I_p \sin(2\Pi ft)$

$di(t)/dt = 2\Pi f I_p \cos(2\Pi ft)$

$v(t)= 2\Pi f L I_p \cos(2\Pi ft)$

In this situation, the phase of the current lags that of the voltage by $\pi/2$.If an inductor is connected to a direct current source with value I via a resistance R, and then the current source is short-circuited, the differential relationship above shows that the current through the inductor will discharge with an exponential decay:

$i(t)=Ie^{-(R/L)t}$

Laplace circuit analysis (s-domain)

When using the Laplace transform in circuit analysis, the impedance of an ideal inductor with no initial current is represented in the s domain by:

$Z(s)=Ls$

Where L is the inductance and s is the complex frequency. If the inductor does have initial current, it can be represented by: adding a voltage source in series with the inductor, having the value:

$LI_0$

or by adding a current source in parallel with the inductor, having the value:

$I_0/S$

Where L is the inductance and $I_0$ is the initial current in the inductor.

## 3. Working Procedure

To obtain the special phase sequence component characteristics according to boundary conditions, then to draw fault component compound sequence network we need first to compare the variation in temperature with respect to current based on the resistance value. To obtain the relationship between current and voltage fault component phasor diagram. We take the values according to the short circuit and the full current voltage. According to the voltage the changes and the fault component can be checked.

Now we then consider current and voltage according to the time and variation in the amplitude. Then according to the face we can deduce the fault point which can be vary according to the criteria possible, in this graph shows that voltage is more or increases in terms of amplitude.

This is a steady state graph between voltage and current. We consider without fault condition between voltage and current so that we can deduce the exact fault condition that will be varying and the variation is recorded so that we give the exact deduction. Now we deduce the fault for passive network which is based on resistance value and it is measured on the basis of voltage and current. The negative and zero sequence component current and voltage at fault point are the same as fault component ones. The positive sequence component current and voltage at fault point are different from the fault component ones. When we analyze the fault component current and voltage, the positive, the negative and the zero sequence networks are all passive networks. This graph represents the variation of fault component for different sequence in all the region of microcomputer protection and according to the boundary conditions we check the fault. We are measuring the fault component for different sequence and then for the exact calculation we have taken the parameter in all the quadrature which is positive, negative and zero and on the basis of those values we actually find all the concurrent fault point by which we can exactly map the condition. Next we are checking the probability of error which is more in the first quadrant and from this graph we are seeing that how the fault is occurring randomly wise.

Graphs shows based on temperature with resistance and produces the outcome of current. Fault component Current and Voltage during kinds of Short Circuit Fault mentioned in this dissertation on the basis of some different considerations. The short circuit current at fault point is the fault component one. In this graph it is more explanative in terms of short circuit current and phase voltage current simultaneously with different parameters.

This graph only represents variation in current between current and amplitude and finally by microcomputer protection we have taken sequence current and voltage by checking the variation of amplitude with respect to time and in this graph it represents that more variation in current in comparison to voltage.

## 4. Evolution and Recent Scenario

In 2010, Yawen Yi et al. [3] introduce the operation mode of auxiliary system in the Three Gorges Hydropower Plant, and some representative problems about the coordination of relay protection are raised and solved successfully.

In 2010, Gaohua Liao et al. [4] observe to enhance power supply reliability for the user terminals in the case of the distribution system to avoid interference by the fault again, rapidly complete the automatic identification, positioning, automatic fault isolation, network reconfiguration until the resumption of supply of non-fault section, a microprocessor-based relay protection device has developed. By use of DSP, device operating realize the real-time measurement, calculation and display for parameters, a combination of difference method with Fourier transform algorithm realize the relay protect for distribution power lines. Sensitive and reliable reflection of the various lines of work and under normal circumstances in non-rapid start to issue warning signal or protection actions in export tripping circuit so that line to security, economic to run.

In 2010, Enrique Reyes- Archundia et al. [5] presents the applications of the Wavelet Transform (WT) for analyzing fast transient signals originated from fault events in power grids with presence of power electronics-based controllers and its protective devices. The study cases included emphasizes the wavelets ability to discriminate signals originated by the fault events from those injected by power controllers, like the TCSC and its associated protection, the MOV, and determine location and electrical distance of the fault to a reference point.

In 2011, Wang Jihong et al. [6] observe that the fault component theory is widely used in microcomputer protection, and fault component exists in the network of fault component, it is necessary to build up the fault component network when short circuit fault emerging and to draw the current and voltage component phasor diagram at fault point. In order to understand microcomputer protection based on the symmetrical component principle, they obtained the sequence current and sequence voltage according to the concept of symmetrical component.

## 5. Test Result

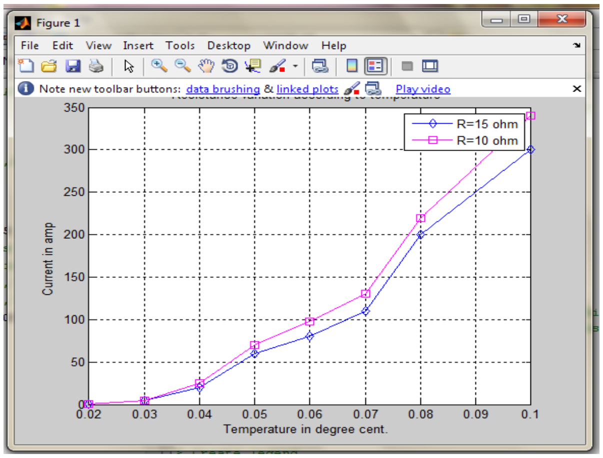


**Fig 1: Resistance Variation according to the temperature.**

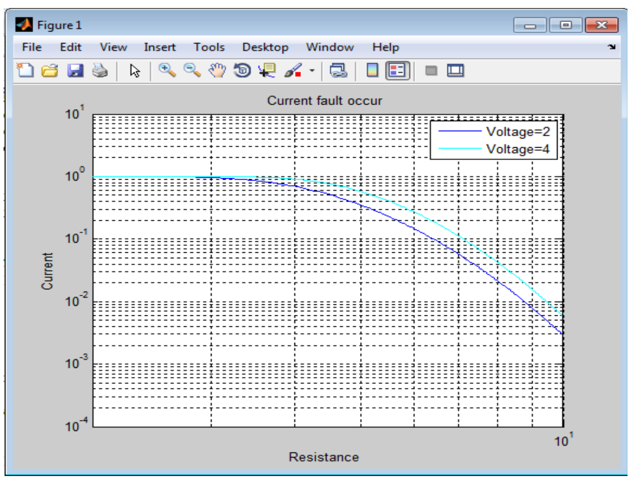


**Fig 2: Current Fault Factor**

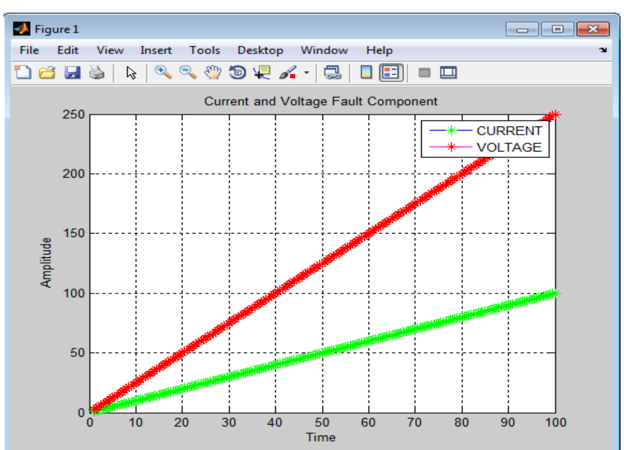


**Fig 3: Current and Voltage Fault Component**

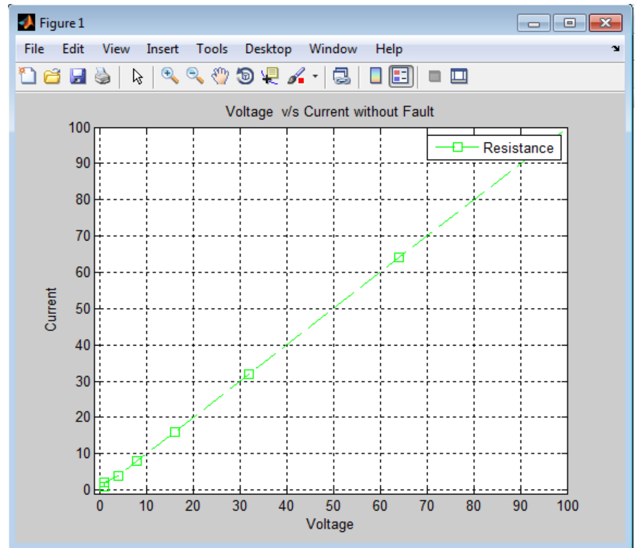


**Fig 4: Voltage vs Current without Fault**

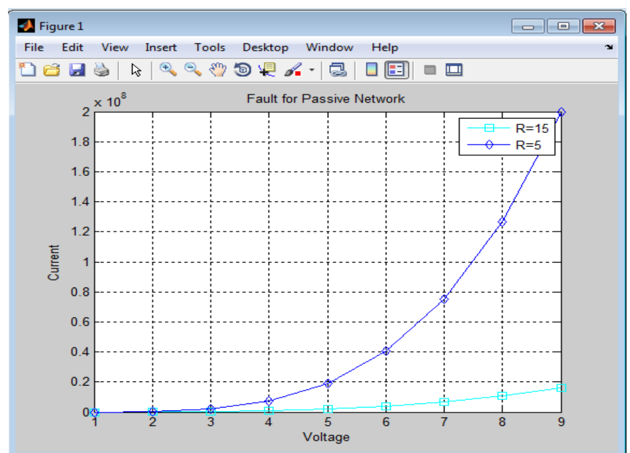


**Fig 5: Fault for passive network**

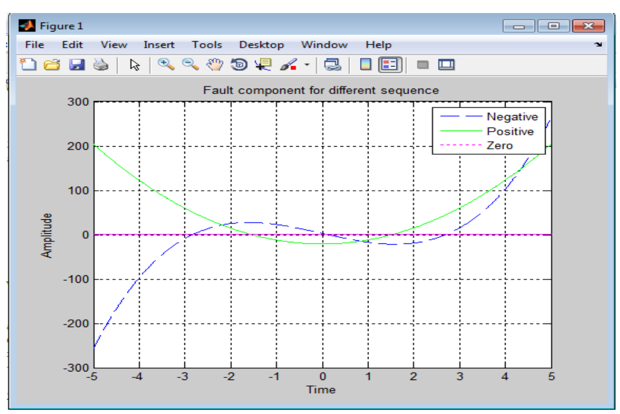


**Fig 6: Fault Component for different sequences**

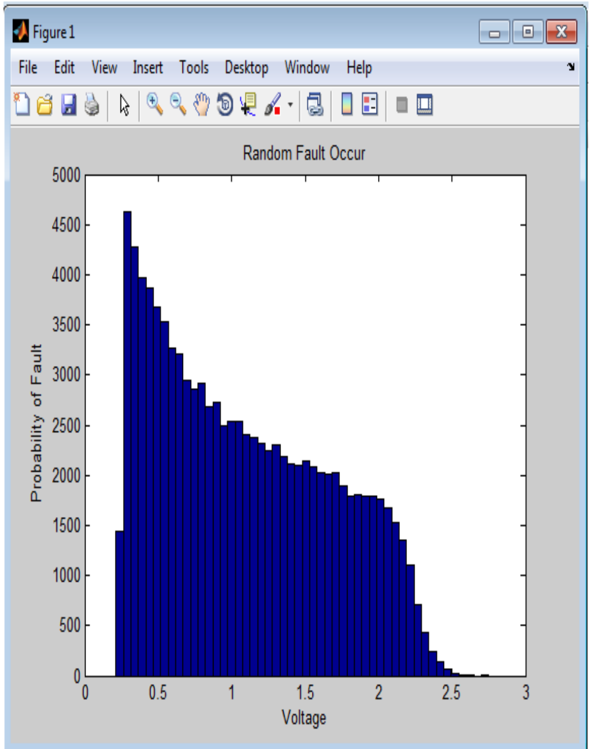


**Fig 7: Random Fault Occurrence**

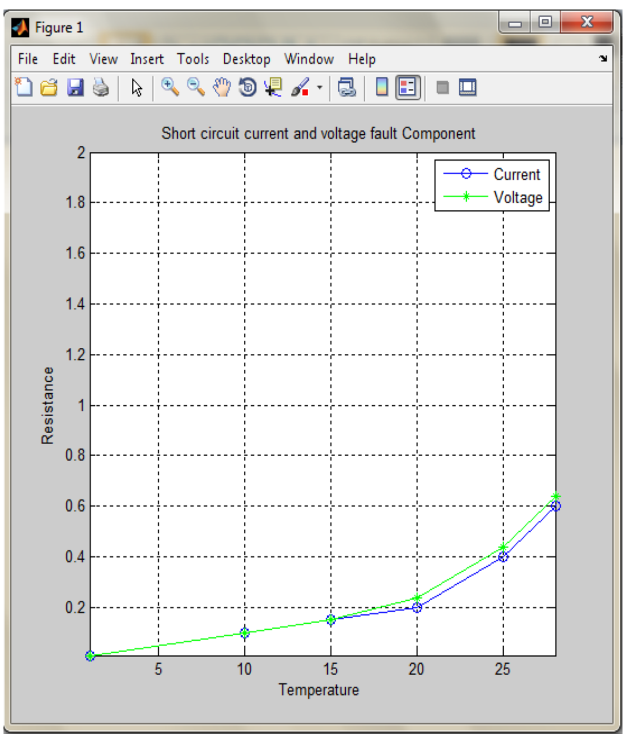


**Fig 8: Short Circuit Current and Voltage Fault Component**

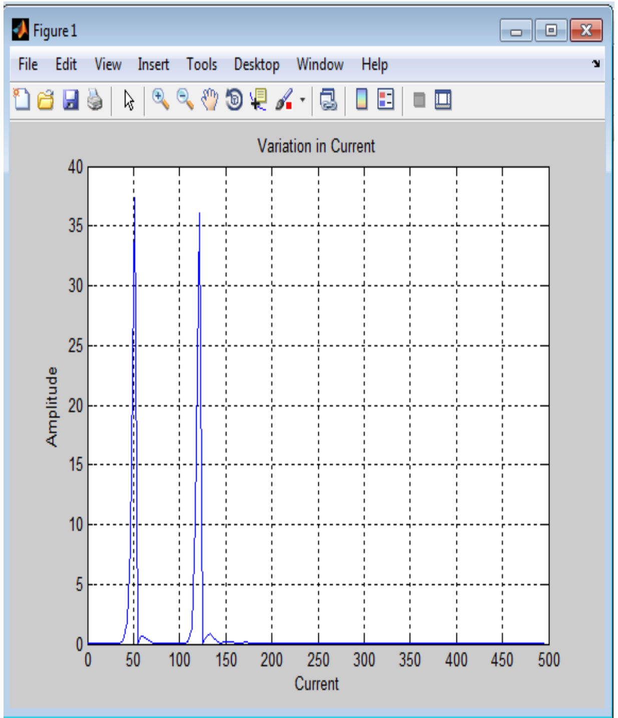


**Fig 9: Variation in Current**

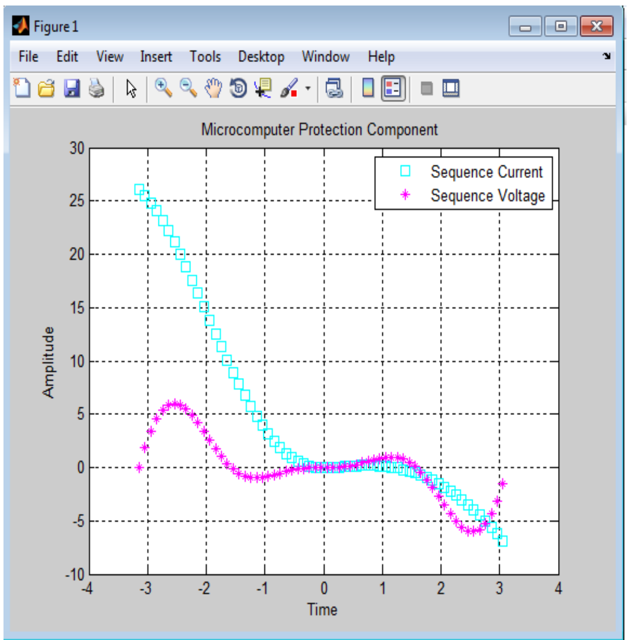


**Fig 10: Microcomputer Protection Component**

## 6. Conclusion

We proposed a special phase sequence component based on the boundary condition. We analysis the velocity according to the relationship between analysis formula and phasor diagram and current in fault component boundary conditions and sequence voltage and current in boundary conditions. The negative and zero sequence component current and voltage at fault point are the same as fault component. The positive sequence component current and voltage at fault point are different from the fault component. So we consider the positive sequences according to that sequences we analyze the fault point. In future we can analyse the aspects with their practical implementations and also the simulation result which shows the advantage graph of our method.

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**Mr. Ashish Choubey** received the B.Tech Degree in Electrical Engg. from TIT Bhilai, Durg in 1999, and the M.Tech Degree in Electrical Engg. from SGSIT Indore (M.P) in 2004. Currently He is an Assistant Professor of Electrical Engg. Department of Jabalpur Engg. College , Jabalpur (M.P)

**Miss Latika Pande** received the B.E Degree in Electrical & Electronics Engg. from Takshshila Inst. Of Engg and Tech., Jabalpur (M.P) in 2008, and the M.E Degree in Electrical Engg. (High Voltage Engg. ) from Jabalpur Engg. College (M.P) in 2012. Currently She is a student in Jabalpur Engg. College.