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Detection Of Power Swing By Decreased Impedance Method

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***Abstract* — Power swing detection on transmission systems is becoming more critical task. Traditionally, The setting of relays for power swing blocking or power swing tripping applications has been very complex and time consuming. Any sudden variation in the load of an electrical network causes power swing. In order to prevent the distance protection from tripping during such conditions, a power swing blocking function is utilized. The decreasing impedance, the Vcosϕ and the superimposed currents methods are conventional algorithms for power swing detection. In this paper the behaviour of these algorithms is evaluated.**

Keywords- Power swing, Algorithms of power swing detection, Stable power swing, fault condition, Decrease impedance method.

I. INTRODUCTION

Power systems in the India have experienced a number of large disturbances, including the largest blackout, which occurred on august 2003.These disturbances happen when the power systems are heavily loaded and a number of multiple outages occur within a short period of time, causing power oscillations between neighboring utility systems, low network voltages, and consequent voltage instability or angular instability.The principle relation of protective relays to the problem of power stability is their vital role in clearing faults as rapidly as possible in order to maintain stability. The opening of healthy line. During swing from which the system can recover, is nearly always undesirable.

II. POWER SWING

A variation in three phase power flow which occurs when the generator rotor angles are advancing or retarding relative to each other in response to changes in load magnitude and direction, line switching, loss of generation, faults, and other system disturbances.

A. Types of power swing

1. **Stable power swing:** In stable power swing system reaches a new state of equilibrium condition.so if there is a stable power swing it is need to give a blocking signal to the relay it is called as **out of step blocking**.

2. **Unstable power swing**: In unstable power swing Severe system disturbances occurs , system not reach a new state of equilibrium.so system become unstable .if unstable power swing is occurs for long time system loss of synchronism , large fluctuation of voltage and current.so it is needed to give a tripping signal to the relay it is called as **out of step tripping.**

III. POWER SWING DETECTION METHODS

There are four methods of power swing detection

- Decreased impedance method
- Superimposed current method
- Vcosϕ method
- decreased resistance method

A. Decreased impedance method

This method is based on that the impedance locus changes slower during a power swing than when a fault occurs. Fig. shows power swing blocking characteristics. The impedance locus to pass through the area between the two characteristics. If there is a fault condition, the impedance locus will move instantaneously, and no blocking will occur. During a power swing, the locus much slower.

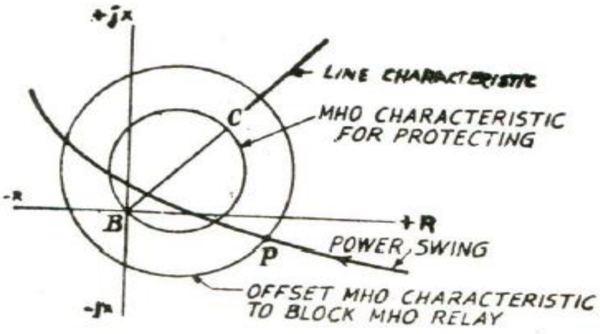

Fig 1.

- Advantage
  - This method is able to distinguish slow power swings.
  - This method may operate for earth faults with high fault resistance.
  - This method is good for compensated line
- Disadvantage
  - If during a power swing a three-phase fault occurs, it is possible that the blocking relay will not reset.

B. Vcosϕ method

When power swings occur different electrical quantities vary as the angle δ at a great. When a fault occurs, electrical quantities change instantaneously. This algorithm evaluates the change in Vcosϕ as a function of time. This value is measured once every half-cycle. Figure shows the changes in Vcosϕ for a three phase fault. The fault has occurred between 2.0 to 4.0ms. As shown, there is only a change in Vcosϕ with respect to time at a rate higher than the setting of the measuring system.

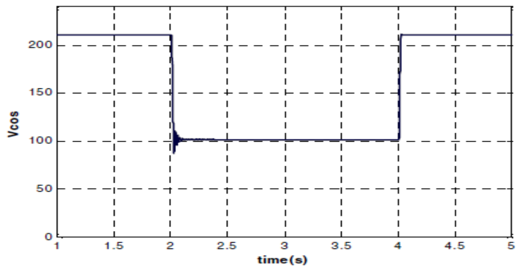

Fig 2.Change in Vcosϕ for three phase fault

C. Superimposed current method

In this algorithm change in change in current used to detect power swing. If the current change is fast then there is a fault and if the current will change slowly then there is a power swing

D. Decrease resistance method

In this algorithms change in resistance used for power swing detection. If the resistance decrease instantaneously then there is a fault and if resistance decrease slowly then there is a power swing.

IV. Model of power system

In this model power swing detected by decreased impedance method
140km length of transmission line
generator rating 600mva , 22kv , 50 hz , ,Xd=1.81p.u,Xd’=0.3,Xd”=0.25p.u,
Xq=1.76p.u,Xq’=1.76,Xq”=0.25,T’d0=8s,T”q0=0.03s,
Transforemer 600 MVA , 22/400kv , delta star , X=0.163pu,Xcore=0.33p.u,Rcore=0,Pcopper=0.00177
Transmission line Z1=0.12+j0.88Ω/km , Z2=0.309+J1.297 Ω/km , C1=1.0876×10^{-8}F/km.

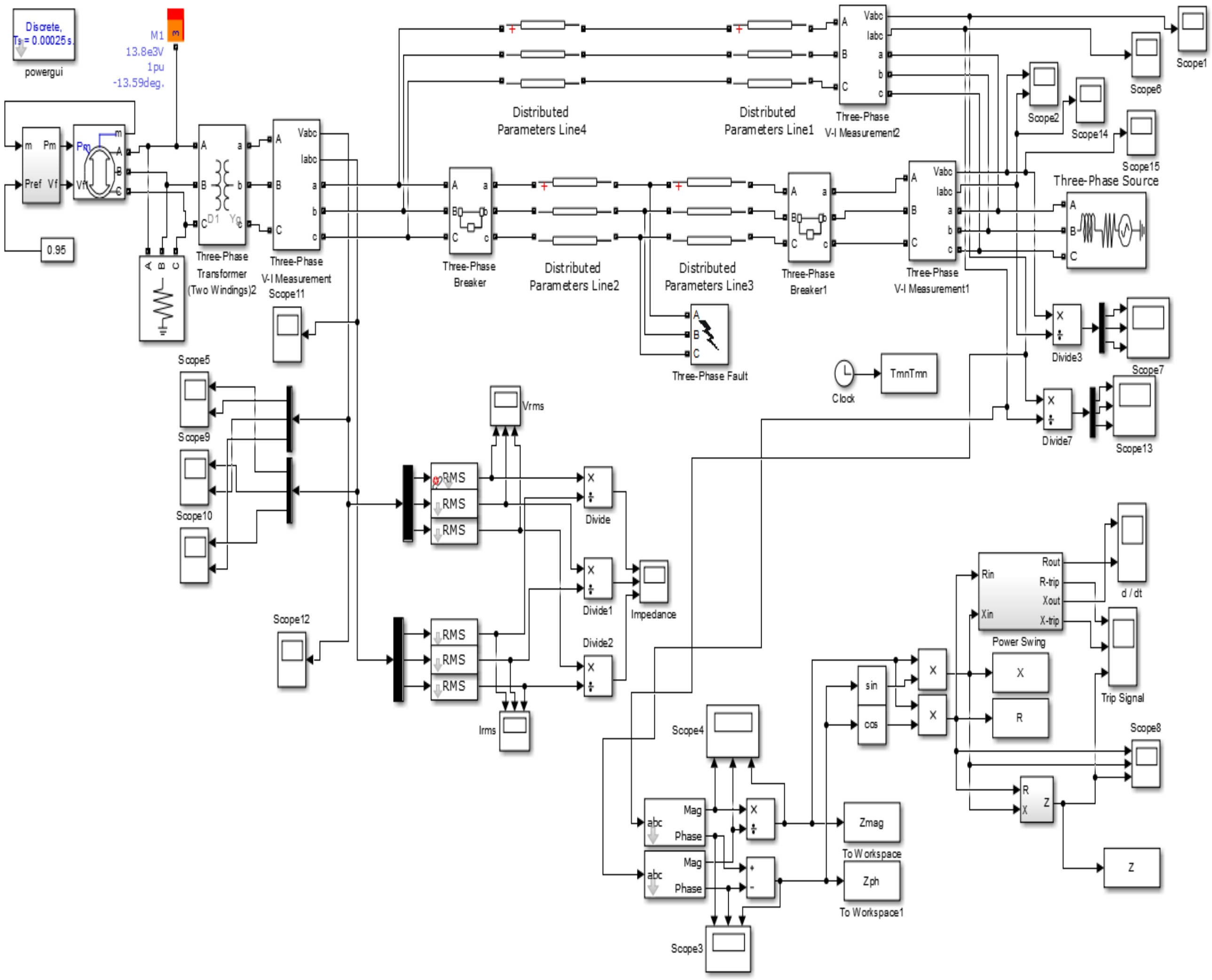

Fig 3.Model of power system

V. RESULTS ANALYSIS

The simulation of system under consideration using MATLAB/Simulink model we observed following results

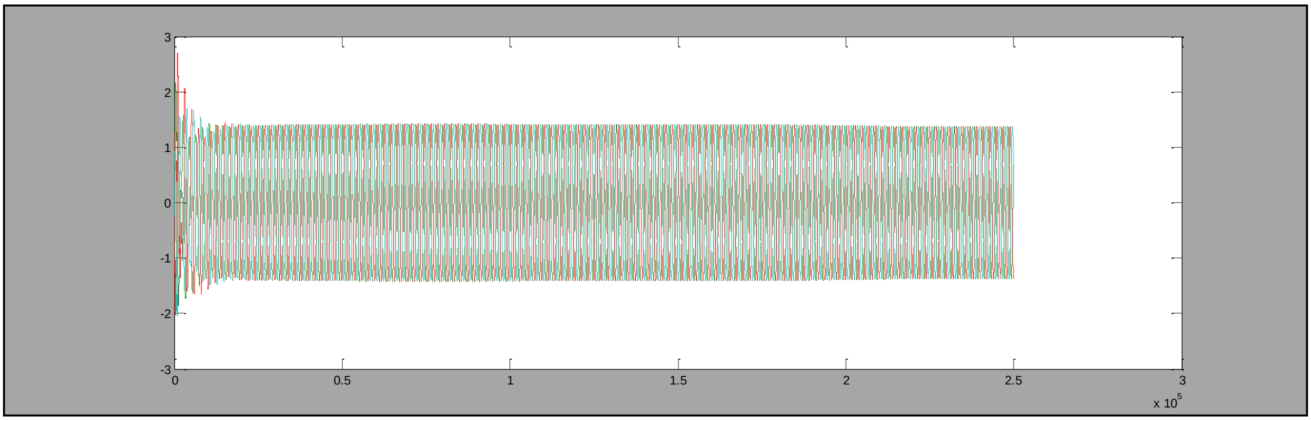

Fig 4. Voltage during normal condition

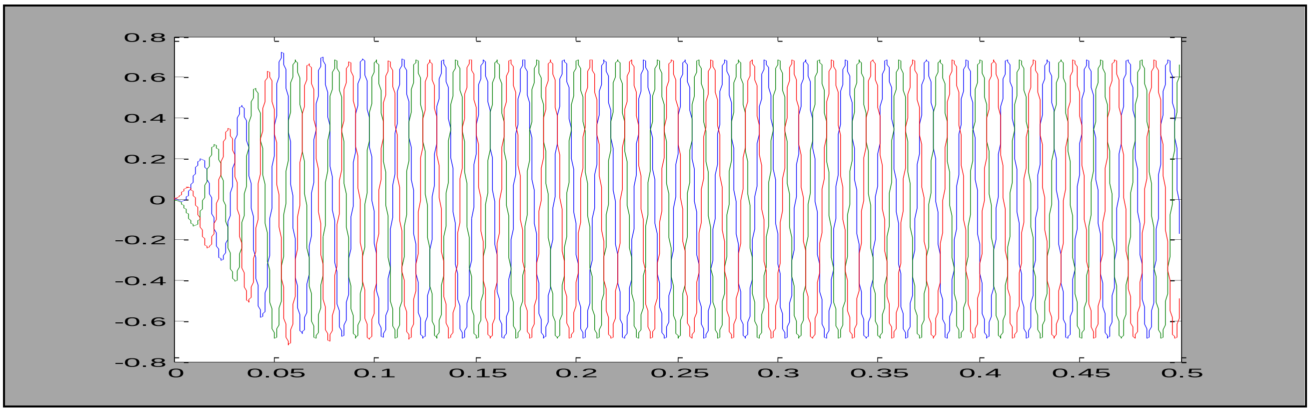

Fig 5.current during normal condition

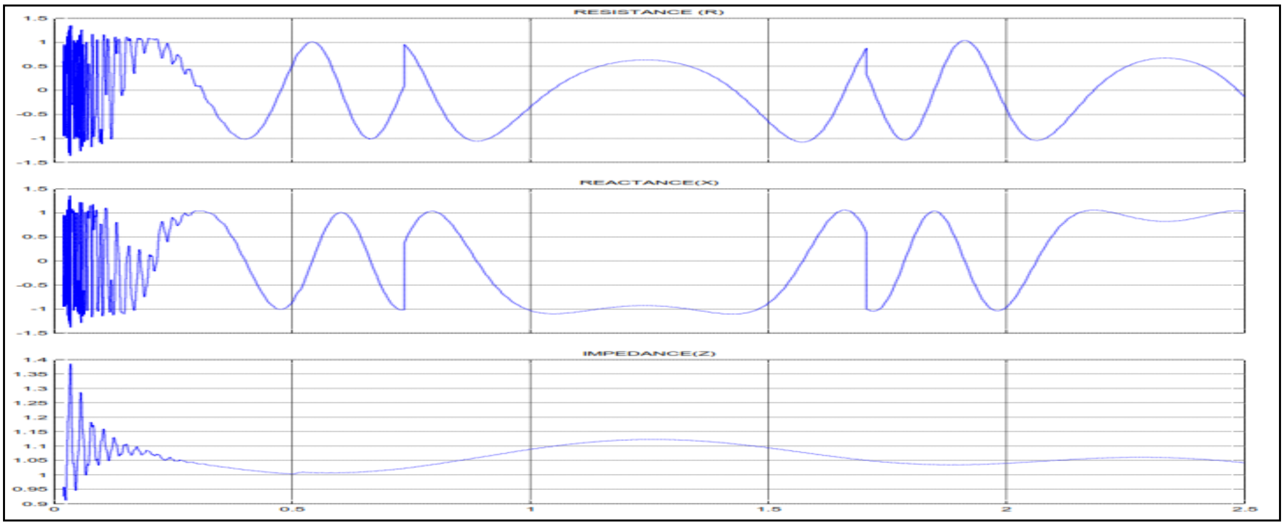

Fig 6. Change in R and X at normal condition

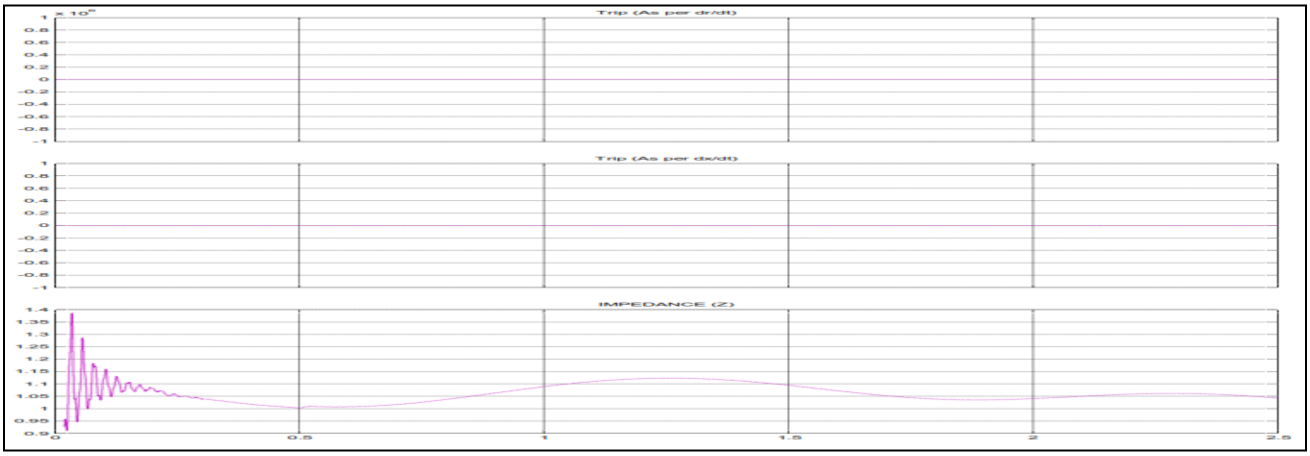

Fig 7.Trip signal as per dr/dt and dx/dt during normal condition

2.FAULT CONDITION

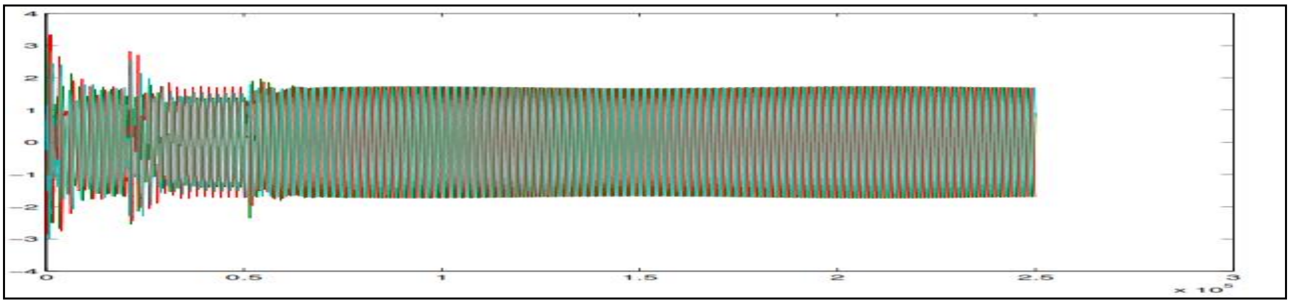

Fig 6.Voltage during phase to ground fault

Figure shows voltage during fault condition. Fault occur at 0.2 and it will cleared after 0.5 second and voltage becomes normal.

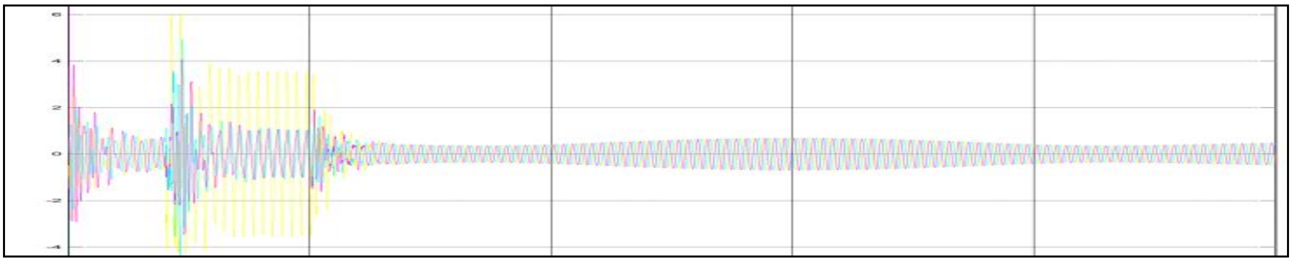

Fig 7. Current during phase to ground fault

Figure 7 shows current during fault when there a fault on line2 power swing is occur on line 1.This power swing is shown in figure 7.

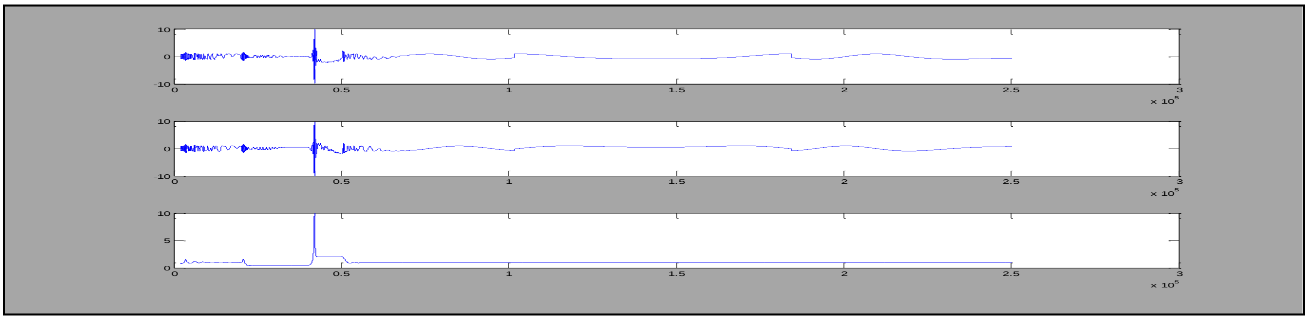

Fig 8.R X Z during fault

Figure 8 shows the resistance, reactance, impedance during the fault condition. Fault occurs at 0.2 for duration of 0.3 sec. The impedance will decrease during fault and it will become stable after clearance of fault.

Fig 9.Trip signal based on dr/dt and dx/dt

Figure 9 shows tripping signal based on change in resistance and reactance with respect to time. When the fault is occur tripping signal provided.as shown in figure when fault is occur impedance will decreased after that it will be steady.

3. POWER SWING CASE

Stable Power Swing Case

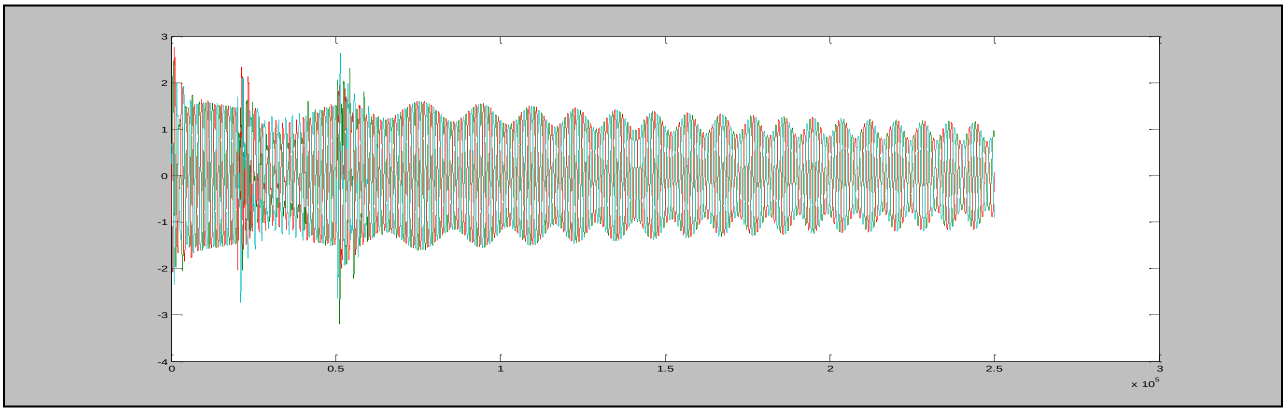

Fig 10. Voltage on line 2 while phase to ground fault on line 1

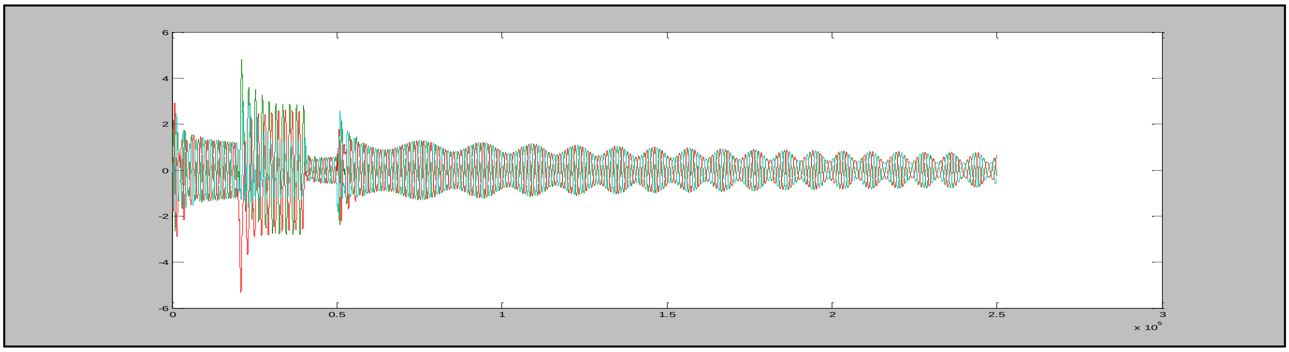

Fig 11. Current on line 2 while phase to ground fault on line 1

Figure 10 shows voltage on Line 1 during phase to ground fault on Line 2. Fig. shows that there is power swing occurs after the clearance of fault. Figure 11 shows current on Line 1 during phase to ground fault on Line 2, there is stable power swing occurs while creating a fault on line 1.

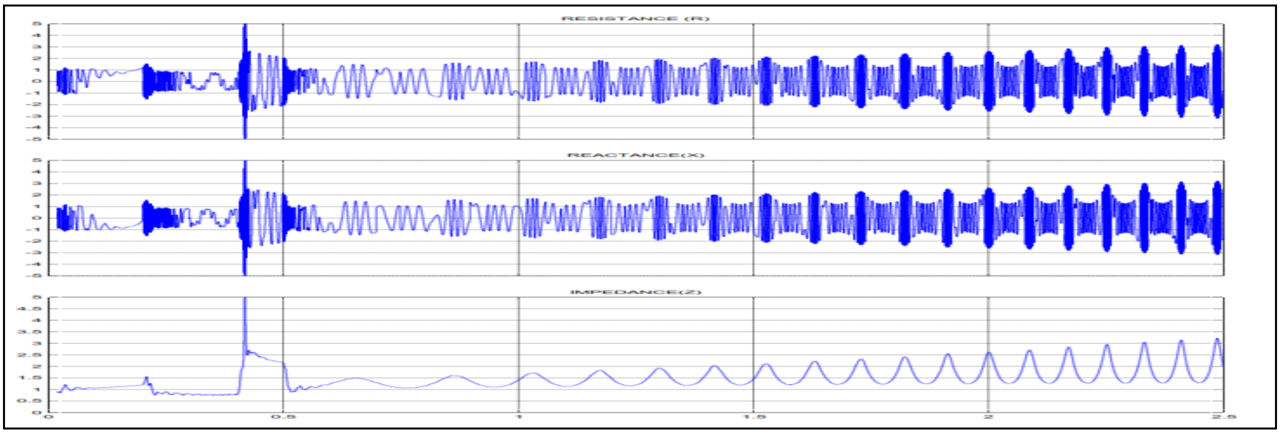

Figure 12. R , X , Z during stable power swing

Figure 12 shows the resistance, reactance, impedance during power swing case while create a fault on line 2.impedance will decrease during fault and after clearance fault it will stable. System detect it as the stable power swing.

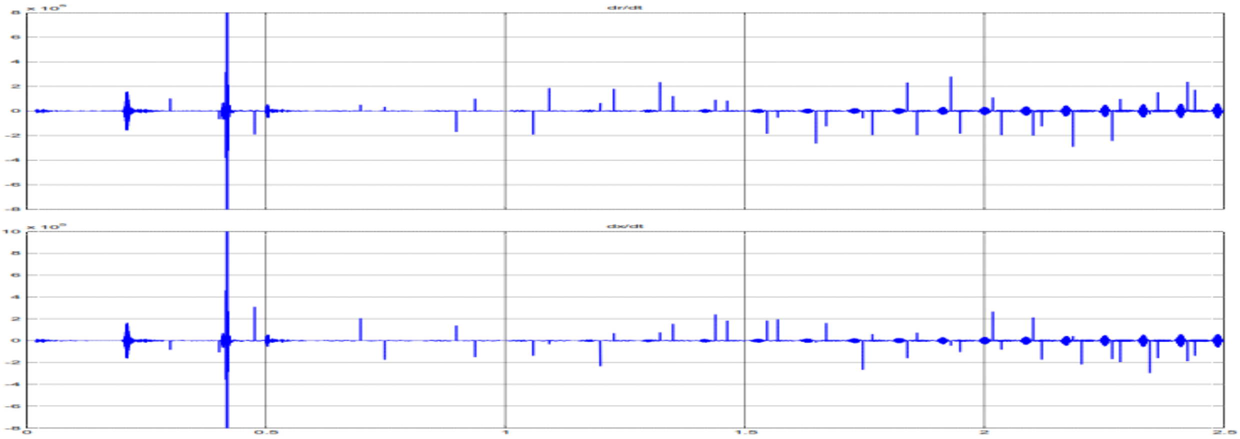

Fig 13.Change in Resistance (dr/dt) and Reactance (dx/dt) during Stable power swing

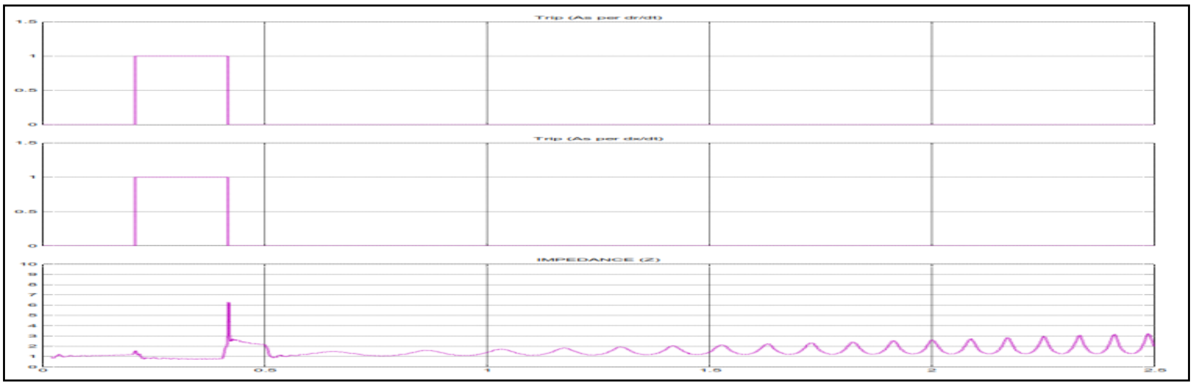

Fig.14 tripping signal base on dr/dt and dx/dt

Figure 13 shows that change in resistance and reactance during the stable power swing and in figure 14 as per change in dr/dt and dx/dt tripping signal is provided. When fault is occur trip signal is provided.as shown in figure fault occurs at 0.2 to 0.5 sec. impedance will decrease during this duration and after when this fault is cleared it will become stable. It is the stable power swing.

VI. CONCLUSION

By the simulations we observed that decreased impedance method can detect the fault and power swing. The detection is based on changing value of Resistance R, Reactance X and Impedance Z. The changing value of impedance seen by relay is used to detect fault and power swing it is also used to discriminate between stable and unstable power swing.

REFERENCES

[1] Study, Comparison and Simulation of Power System Swing Detection and Prediction Methods Majid Sanaye-Pasand, Member *IEEE Ali Naderian Jahromi.*

[2] Distance Relay With Out-of-Step Blocking Function Using Wavelet Transform Sukumar M. Brahma, *Member, IEEE*

[3] Evaluation and Performance Comparison of Power Swing Detection Algorithms in Presence of Series Compensation on Transmission Lines. , Ahad Esmaeilian1, Amin Ghaderi2, Mohammad Tasdighi1, Alireza Rouhani 1*University of Tehran 2*Iran University of Science and Technology Tehran, Iran

[4] A New Method for Fault Detection during Power Swing in Distance Protection , H. Kazemi Karegar , B. Mohamedi Shahid Beheshti university , Tehran, Iran

[5] A Fault Detection Technique for the Series-Compensated Line During Power Swing IEEE TRANSACTIONS ON POWER DELIVERY, VOL. 28, NO. 2, APRIL 2013 , Paresh Kumar Nayak,Ashok Kumar Pradhan, *Senior Member, IEEE, and Prabodh Bajpai, Member, IEEE*

[6] A Comparative Assessment of Power Swing Detection Techniques P.K. Nayak, J. Ganeswara Rao, P. Kundu, A. K. Pradhan and P. Bajpai

[7] New principle for high resistance earth fault detection during fast power swings for distance protection , IEEE Transactions on Power Delivery, Vol. 12, No. 4, October 1997A . Mechraoui and D.W.P. Thomas, Member, IEEE. Department of Electrical and Electronic Engineering University of Nottingham , NG7 2RD, UK.