REDUCING FAULT CURRENT BY USING NON SUPERCONDUCTING FAULT CURRENT LIMITER

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Abstract*-Now a days faults are increased enormously so there is a need to reduce the faults as our consumption is increasing day by day. As there is need to protect our electrical equipment we should use the Protection device as it reduces the fault current. The more power grids are come forward to supply the power to the customers. Fault currents are more in the electrical system(Majorly at transmission system & power grids) and may exceed the short circuit fault current limits of a existing protection devices. Alternative another system is there to reduce the fault current rather than the protection devices. There are very advantages and applications in a Non Super Conducting Fault Current Limiters (NSFCL). The NSFCL is protect against the fault current i.e short circuit and reduces the short transients work in conjunction with existing protection devices. The NSFCL are less expensive and less expensive and easy to design and low cost.in this paper we clearly explain the operation of NSFCL under normal condition and the NSFCL works different in a faulty condition systems*

Index terms- Non superconducting fault current limiter (NSFCL), Protection devices, power grids, short circuit transients

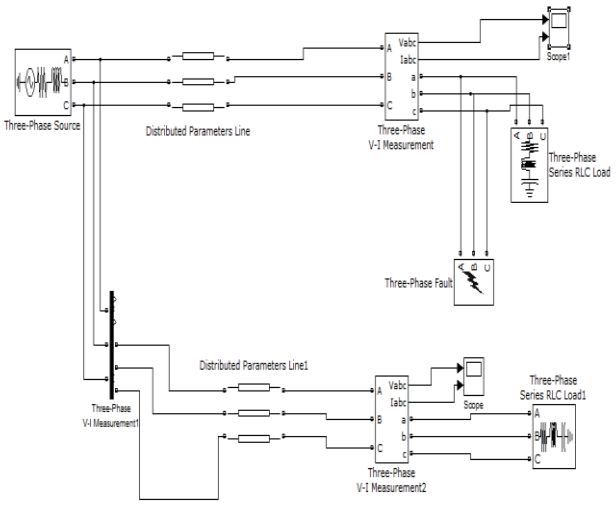
Introduction

According to today's circumstances the ever growing needs of the electricity, power consumption has been increasing and there is no interruption of the supply particularly with the independent power producers. In modern life the renewable electrical energy is more has there is more number of the distributed generators connected to the grids. As there is a fast expansion of generation at the same time the fault current also increases. Due to the short circuit current, fault currents there is a chance of damage a electrical equipment like Circuit Breakers, Cables, Switch Gears etc. Fault current can damage the insulation of the cables and oil filled equipment causing fire (or) explosion.

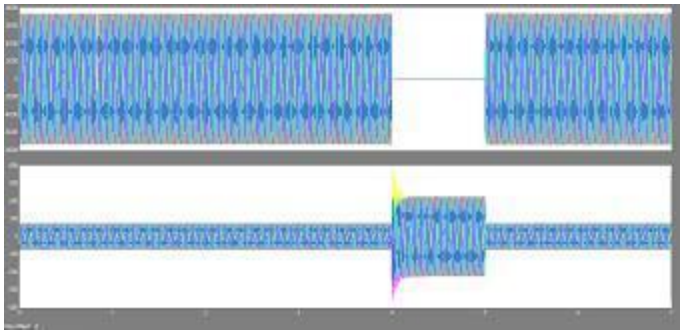
The circuit and waveforms below shows that a fault occured on a transmission line and how severe it can be and how much it is more than the actual current.

In the above fig the fault occurs and the voltage becomes zero and the current is so high (upto400Amps). There is a equipment like Circuit Breakers, Transformers, Relays are most costly equipment are placed such that the damage will occur due to the fault currents. The waveforms are shown in fig and under normal operations means without any fault there is no interruption in a voltage and a current shown in a above waveform

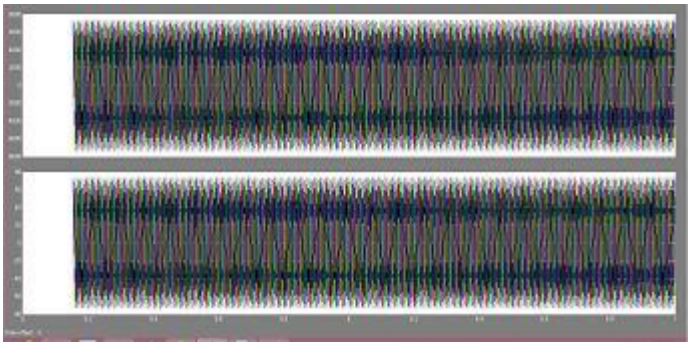
By using the Non superconducting fault current limiter (NSFCL) we can reduce the magnitude of the fault current and protect the valuable equipment like Cables, Circuit breakers, Relays, Timers without any interruption to the load.



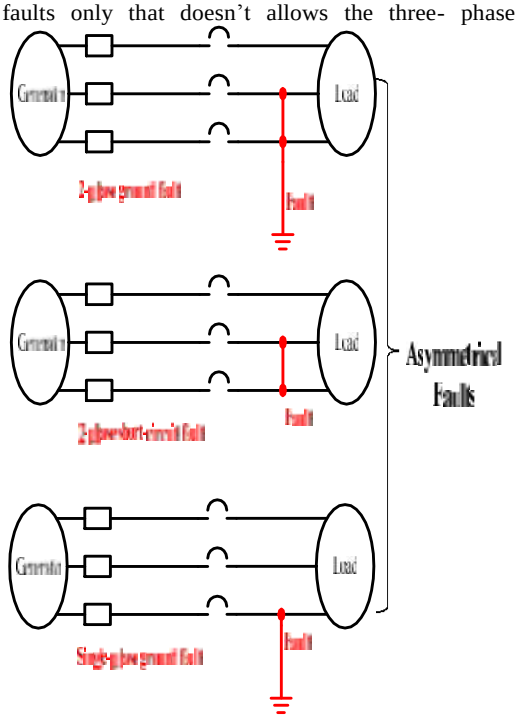
The wave form of the normal line [without any fault] as shown in a below figure



The below wave forms shows the transmission line with out any fault there is no interruption in a voltages and currents.



faults only that doesn't allows the three- phase faults.



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II SHORT CIRCUIT FAULT TYPE

There are two types of a short circuit fault in a Three-phase power system

a) Symmetrical faults
b) Unsymmetrical faults

a) Symmetrical faults

The three phase symmetrical faults and the three phase short circuit faults. In these type of faults all three phases are effected and the power delivered to the loads is zero. The system is completely not changed

b) Unsymmetrical faults

In unsymmetrical three-phase fault currents the all three phases are not affected. In unsymmetrical three-phase fault current it includes the two-phase fault, single-phaseto ground fault. In this type of fault the power supply to the load is not interrupted. Majority the fault currents are the unsymmetrical

In the most power systems the source and line impedance are both resistive and inductive in nature. The short circuit fault is similar to the closing an RL circuit. In a fault conditions there is a presence of both AC symmetrical current and there is a presence of some sort of asymmetrical D.C offset current.

Symmetrical AC components

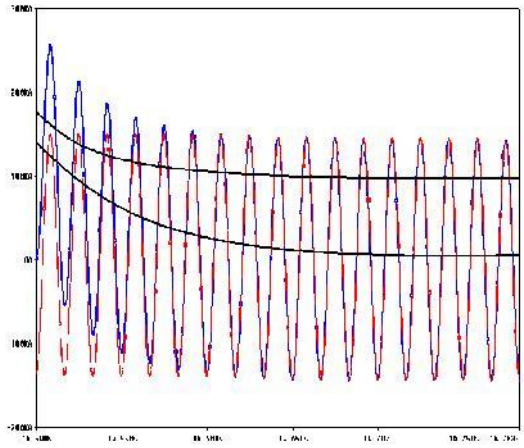
The symmetrical AC components consists of a RMS value of a fault current and they are used for Ampere Interruption Rating Devices (AIR) of a protection devices like Fuses and Circuit Breakers.

Absolute current (Max I_f)

The absolute current is a maximum value of the actual fault current. It is a first peak value of the offset asymmetrical current waveform. The max I_F implies that the maximum mechanical force produced by the fault current, hence it gives a final value for mechanical design of bus bar and supports.

Momentary current (I_{fm})

It measures the asymmetry of the actual AC current and is an indicator for required breaking capacity and high voltage switch gears. The momentary currents gives the RMS value corresponding to the half cycles of the current waveforms.



ANALYSIS OF FAULT CURRENT LIMITER-

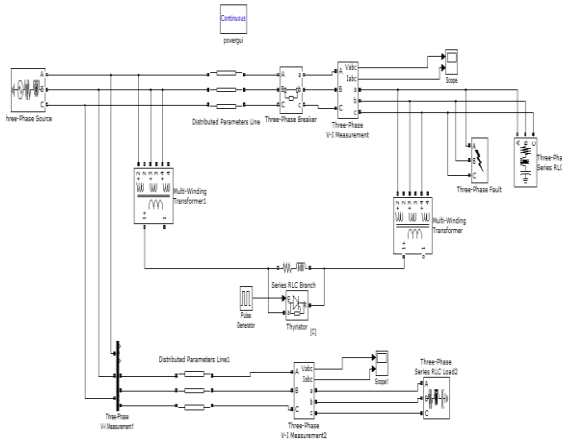
Fault current limiter is nothing but a variable resistance and variable impedance connected in series to reduce the fault current under normal operation the fault current has a low impedance and under some abnormal conditions like a short circuit current and the fault current limiter goes to the high impedance state.

POWER CIRCUIT ANALYSIS AND PROCEDURE

In this paper we shall discuss about the Non super conducting fault current limiter operation and how it eliminate the fault current and where it can be applied. The main parameters that should be considered are

a) Circuit Topology

Consider a generating station is given to the is given to the three-phase transmission linesand at the end there is a three-phase load is present and at the same time the another line is fed from the same generating stations. Due to some abnormal conditions like.windblown, tree branches are fallen on a transmissionline and short circuit occurs in circuit as shown in figure I.



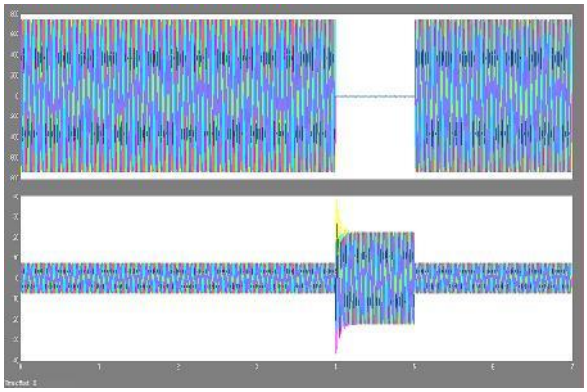
The figure shows

In a super conducting fault current limiter circuit consists of a multi winding transformer at the sending end and the receiving end and series RL circuit is placed in between the two transformer and placed in between the two transformer and placed a TRIAC parallel to the series circuit and gate pulse is given to the TRIAC. The TRIAC is controllable device than diode. TRIAC is a device which consists of a SCR in a anti parallel and it works in both directions either it may be work in a both directions either it may be work in a positive direction (or) negative direction. It is easily to construct the TRIAC breaks down the voltage either in direction is possible.

b)Normal condition with NSFCL:During normal operation the power flows from the three-phase source to the multi winding transformer acts like a step down transformer and the current flows from the TRIAC and goes to the multi winding transformer with step up voltage. When we give the gate pulses the TRIAC starts conducts then voltage is given to the load. The main function of the multi winding transformers are to power is given to the load without any drop of a voltage and current respectively.

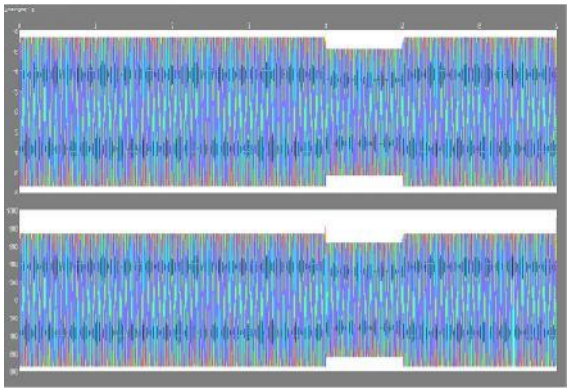
C)Abnormal conditions with NSFCL:

During abnormal conditions like a short circuit occurs, windblown. Whenever the fault occurs on a circuit(C) the power fed from the



generating stations and the same power During Abnormal conditions with the NSFCL the current is limiting from a 400 AMPS to 40AMPS i.e it can limit the current 100:10ratio is shown in a below waveform(D)

D) Effect of a fault in a another transmission line while using NSFCL: The below wave forms shows that is a slightly voltage and current drop occurs in a transmission another transmission line



Advantages of a (NSFCL) :

1) Efficient and non intrusive:
   During normal operation the FCL should be minimum such that the power loss and voltage drop in the transmission line reduced and the harmonics are reduced in the transmission lines.
2) Fast action:
   The FCL takes the actions within first half cycle upon the fast occurrence.
3) Fast recovery:
   It doesn't requires the reclosing action in relays & protection applications.
4) Low cost:
   There is no interneddiate device to be added for protection. The cost of the FCL should be minimum when compare to other protective device.

Disadvantages Of a (NSFCL):

1).While using a (NSFCL) there is a some small voltage drop effected in a another transmission line .

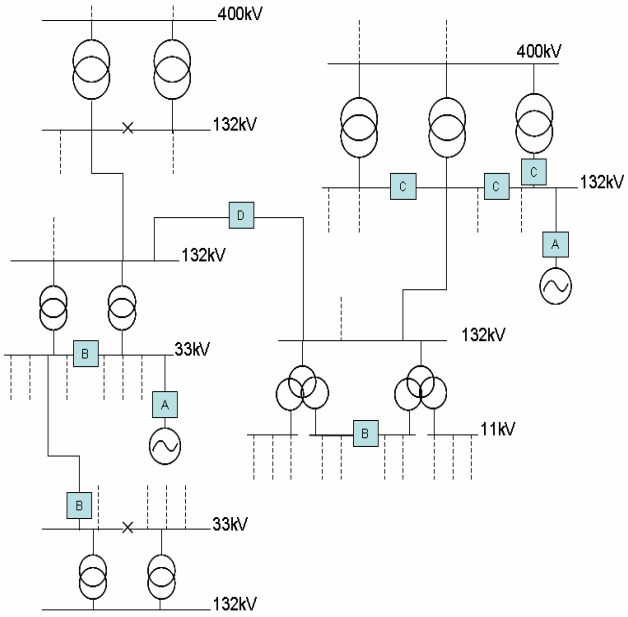
Applications of a (NSFCL):

1)power plant auxiliary systems :A power plant auxiliary systems is a systems which supplies a power to the low voltages power appliances such as lighting systems, fire and safety equipments and the low power equipments are used in a power plants. If fault occurs on the one of the generator in the power plants then the fault may me high(or)medium(or)low if place a NSFCL at the auxiliary systems then we reduce a magnitude of a fault current.

2)Ship Propulsion system: In a modern life the all propulsion system design is shifting from mechanical to electrical drives. The maximum rated installed in all electric propulsion systems is a 150MW.the range of the low voltages in a electric propulsion ship range between the 5kv to 15kv .To operate the low voltages then there is a required for a high rated protection devices in that cost is very high. The NSFCL is connected between HV AND LV lines then the fault current is limited with a more effectively and with a less cost.

3)Distributed Generations Systems(DGS): In a electrical generations systems distributed generation plays a important role . in a modern life the distributed generations are increases day my day. If the DGS increases then potential fault current levels also increases on the power grid bus . to limit the fault current we are using the NSFCL between the DGS and the power grid

4)Practical applications :Instead of using a active fault current devices could be built a non super conducting fault current limiter (NSFCL)to limit the fault current and neglect the fault current devices. For efficiently reduce a magnitude fault currents by using a NSFCL technology. The above figure shows the applications of the (NSFCL) in a MV network . it can used in a isolated LV switch board and substations if any fault occurs the fault current can be reduced at the end of the consumers and it also be reduced at the level of harmonics and flickers. Due to that the reliability of a distribution systems can be improved by coupling bus bar at the MV substations.



5)HV GRIDS : The non super conducting fault current limiter (NSFCL) is used in a HV grids . by splitting the 132 kv bus bar is a only solutions to reduce the high levels fault current problems and the system will be a more flexibility . increased 132kv system reliability and utilization of the existing transformers and circuit can be used of the HV NSFCL of the coupling of the busbars and the transmission feeders shows the following benefits.

1.Harmonics and flickers can be reduced and increases the power quality.

2.very small amount of a voltage drops occurs.

3.when can operate a parallel transformers at the low voltage levels.

4.reduces the power losses and increases the efficiency of a system.

Conclusion:

Hence we effectively control the magnitude of a fault current with a less cost and increases a system reliability.we control the magnitude of a fault current from 400AMPS – 40AMPS (as shown in the above wave forms) by using NON SUPER CONDUCTING FAULT CURRENT LIMITER (NSFCL).

ACKNOWLEDGMENT :

We want dedicated this paper to our parents. We are first of all thanks to our parents.who encourage us a lot and build our confidence. We would like to thanks our ASST.PROF L.Karunakaran who constantly provided a support for our research with his vast knowledge in this field for his countless advices. We are great thank full to karunakaran sir because a his dedication with great patience .At last we are most thank full to our beloved friend S.Abhinav setty who help us very lot while writing the research paper and encourage a lot and build confidence .

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10. with the help of my friend S. ABHINAV SETTY pursuing B.TECH

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