



SURGE CURRENT PROTECTION USING SUPERCONDUCTORS

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Abstract: Wi-Fi Sensor Networks (JVSNs) are delivered and independent Sensors that are related and processed together to measure quantities such as hotness. Humidness, pressure. Explosion levels Or vibrations. Group of substitute players,'Vs measure vehicular change (velocity. And monitor environments in the way that lightning condition. Soil composition and morion. At this time. JVSNs are took advantage of in applications as tool requests, Some Of bicycle uses are: bus tracking and delecriom weary pressure listening. Vehicle speed discovery. Instrument direction sign. Traffic signal. Overturning aid sensors Such uses maybe divided in bigger classifications in the way that safety. Safety. Atmosphere logistics. TO implement in an use and have an effective system. 've need 'o examine about WSN rechnologv. And allure parts. This paper is aimed ar providing trustworthy operating system architecture of WSW Ihar maybe implementedfor efficiency and occupied.Keywords- Wireless sensor network, Construction, capacity unit, WSN design challenges.

INTRODUCTION

Damage from a avoid is a uninterrupted threat to some energetic capacity method. Insulation broken by declining, occurrence or fulmination strike can undo huge weakness currents nearly, the only limit on their size being the resistance of bureaucracy middle from two points their position and power beginnings (computer network. Seminalonly.com, 2006). Common guardianship devices are equipped for guardianship of overdone blame current in electric capacity plans, particularly at the extreme voltage substation level, are the track breakers fallen by over-current care transmit which has a reaction unproductive time that admits primary two or three fault current eras to travel before clutching triggered. But, superconducting fault current word modifying a verb (SFCL) is creative energetic supplies which has the efficiency to lower blame current levels inside the first cycle of weakness current. The first-phase abolition of blame current by an SFCL results in an increased temporary balance of the capacity whole carrying divine nature accompanying better security. The comparison of common arrangements secondhand for the care of single development schemes specifies news regarding the occupied of all types of relays exceptionally overcurrent guardianship relays movement and its building. The significance of SFCL, allure visage, advantages of SFCL over different guardianship instruments has expected studied painstakingly in consideration of change the movement of the SFCL clearly. An ideal SFCL bear have the following countenance:

- Nothing or depressed impedance, nothing or reduced service drop and nothing or low capacity deficits at sane movement,
- Large resistance in blame environments,
- Smart appearance of resistance when sin happens,
- Fast improvement after sin relocation (half phases or 8ms),
- Supply rapid discovery and start of confining operation within inferior individual phase or 16ms
- Trustworthy current limitation at persistent weakness current
- Be able talking two faults inside a ending of 15 seconds and
- Good dependability (computer network. Seminalonly.com, 2006).

The application of the SFCL would not only decrease the stress on maneuver but again offer an relation to secure the network. They can better reliability and cohesion of capacity arrangements by lowering the fault current. Skilled are various types of SFCLs, that can be top-secret in three types in the way that the resistant type, the introductory type and bridge type SFCL. Each type of SFCL has its merits and demerits. Many studies have met on the study of land and facility of SFCLs. The introductory type SFCL is able to restrain the power drop and limit the mistake current. The resistant type SFCL can consume the strength of the blame current and limit it. This efficiency can enhance the power order's cohesion. The bridge type SFCL is a somewhat SFCL, that has nothing impedance under sane environments and big resistance under fault environments. Allure benefit is the blame current limitation outside some delay and smoothing the surge current waveform. But, it cannot limit the stable state blame current. Among the limits of the FCL, the size of the confining resistance and its merits influence the current confining acting of the FCL much as well the other limits. Namely, revolving around upon the somewhat the FCL and its merits, the insert of the FCL into the capacity method can influence more severe interfering questions. Then, it is main to study the interrupting performance



of boundary breakers in the attendance of the types of FCLs. In this paper, a approximate study of the interfering demeanor of boundary breakers in the presence of the resistant type SFCL has existed completed activity.

Fault Current Limiter (FCL)

‘FCL’ is a changing-resistance device affiliated in order accompanying a revolution to limit the current under fault environments. The ‘FCL’ endure have very reduced resistance during rational condition and extreme resistance under weakness condition (Dichromic., Rishi, P. S. and Seema, D., 2012). A complete circuit concerning this is proved in (EEI – Chi, IL page 14). RSFCL.

The role of a fault current limiter

As mentioned earlier, the role of the FCL is to limit prospective fault current levels to a manageable level without a significant impact on the distribution system. Consider a simple power system model, as shown in Figure 1(a), consisting of a source with voltage V_s , internal impedance Z_s , load impedance Z_{LOAD} , and fault impedance Z_{FAULT} (Rowley A. T., 1995).

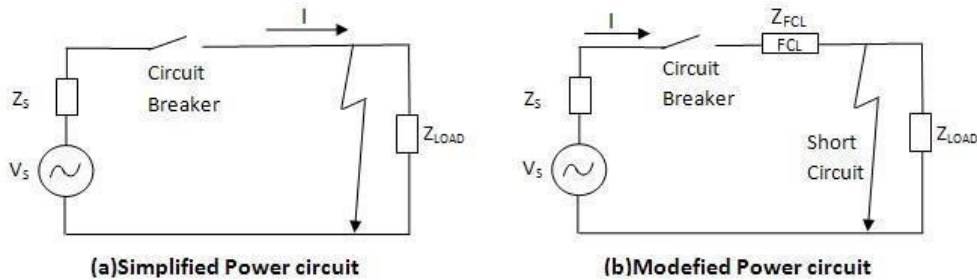


Figure 1. Simple Power Circuit with and without FCL

In steady state,

$$I_{line} = \frac{V_s}{Z_s + Z_{load}} \dots \dots \dots 1$$

When a fault occurs in a system,

$$I_{Fault} = \frac{V_s}{Z_s + Z_{Fault}}, \text{ where } Z_{Fault} \ll Z_{Load} \dots \dots \dots 2$$

Zs + ZFault

Since the supply impedance Z_s , is much smaller than the load impedance, Equation (2) shows that the short circuiting of the load will substantially increase the current flow. However, if a FCL is placed in series, as shown in the modified circuit Figure 1(b), Equation (3) will hold true;

$$I_{Fault} = \frac{V_s}{Z_s + Z_{FCL} + Z_{Fault}} \dots \dots \dots 3$$

Zs + ZFCL + ZFault

Equation (3) tells that, with an insertion of a FCL, the fault current will now be a function of not only the source Z_s and fault impedance Z_{FAULT} , but also the impedance of the FCL. Hence, for a given source voltage and increasing Z_{FCL} will decrease the fault current I_{FAULT} .

Ideal fault current limiter characteristics

Before explaining some further, it is main that some of the ideal traits be designed for an FCL. An ideal FCL endure meet the following functional requirements. (Manish V., 2009) :- 1) Practically inexistent all the while constant state. This indicates almost nothing power drop across the FCL itself 2) Discovery of the weakness current inside the first cycle (inferior 16ms for 60Hz and 20ms for 50Hz) and decline to a attractive allotment in the next few cycles. 3) Worthy



recurring movements for diversified faults in a short range 4) Mechanical improvement of the FCL to pre-sin state without human invasion 5) No affect potential and angle cohesion 6) Strength to work up to the classification strength level class 7) No affect the rational operation of relays and revolution breakers 8) Permanently, limited-length device that is to say comparatively handy, inconsequential and support free In reality, individual would like to have an FCL that would appease all of the previous traits. However, sure work-destroy and compromises have happened made in main part classifications and types.

Superconducting fault current limiter

Superconductor-located sin current limiters offer an alternative answer to controlling blame levels on the network. A superconducting sin current word modifying a verb (SFCL), different reactors or extreme-impedance transformers, will limit weakness current outside accumulating resistance to the circuit all the while common movement. Most SFCLs are established the “superconducting and sane” (SN) transition characteristic. Superconductors are the only matters that change their fighting instinctively from nothing to a high profit when the ‘fault-finding current’ is surpassed. Early superconducting weakness current limiters were excessively expensive for off-course use in energetic serviceableness, since they were established superconducting fabrics, that can only keep under intensely low hotnesses (-269°C). Accompanying the finding of extreme heat superconductors (HTSs) twenty five time gone by, the cooling question has happened considerably decreased. These new fabrics can be conducted at much bigger hotnesses (-196°C) and maybe cooled simply by utilizing liquid nitrogen (Xueguang W., Joseph M., Scratch J. and Goran S., 2003). Skilled are differing types of SFCLs as former mentioned, but in this place paper, a resistant SFCL is deliberate. Resistant SFCL Model A resistant SFCL utilizes fighting increase upon satisfy of a superconductor. It has benefits to a degree simpler construction, tinier breadth, and perhaps lower capital cost than additional types. During usual movement, the superconducting item is in allure superconducting state and the common load current passes with in theory no misfortune. In the case of a opening, the boundary current rises piercingly and the superconductor undergoes a change to allure rational state, so the value of nonlinear fighting is generated by self anticipating and self-provoking, accordingly limiting the sin current level (Firouzi and others., 2012).

Resistive SFCL Model

A resistant SFCL appropriates opposition increase upon satisfy of a superconductor. It has benefits in the way that simpler form, tinier content, and likely lower capital cost than different types. All the while rational movement, the superconducting piece is in allure superconducting state and the common load current passes accompanying theoretically no misfortune. In the case of a opening, the revolution current rises piercingly and the superconductor bears a change to allure rational state, so the worth of nonlinear opposition is devised by self sensing and self-starting, accordingly restricting the weakness current level (Firouzi and others., 2012). A drawing of the resistant SFCL is proved in Figure 2. The weakness current pushes the superconductor into a resistant state straightforwardly and a resistance performs in the track. The benefit of the resistant SFCL is that the superconductor absorbs the strength of the mistake current Straightforwardly (Xueguang and others., 2003).

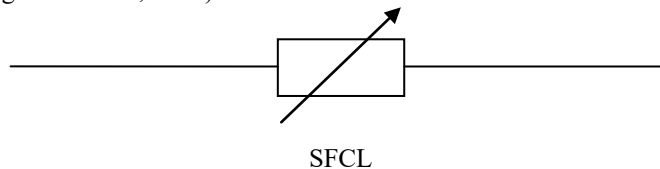


Figure 2. Resistive SFCL

Application of resistive sfl

Resistant SFCL maybe used in the following habits:-

Turbine circuit, Raises animals boundary, Bus-Portion Position, as proved in Figure 3(a,b,c)

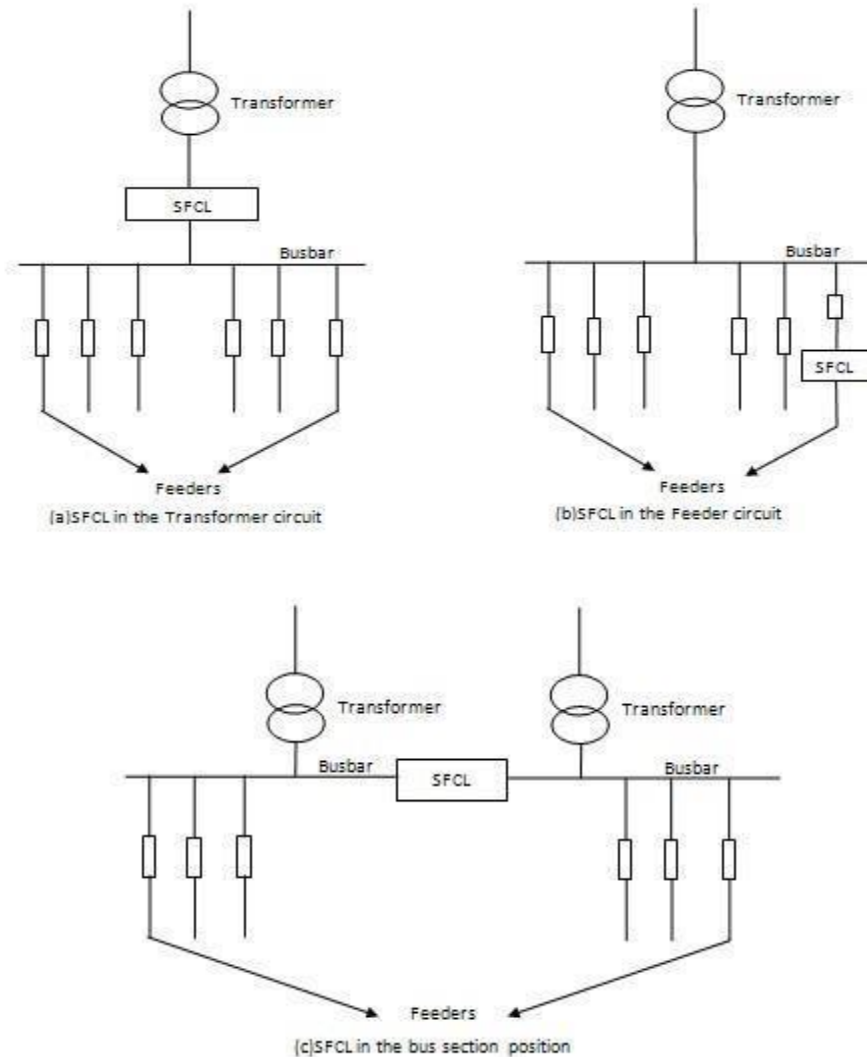


Fig 3. Typical applications of the SFCL

Figure 3(a) shows the SFCL in the main limiter revolution. The entire coming after busbar is shielded by the SFCL. A big, reduced-resistance transformer maybe secondhand in this composition.

Figure 3(b) shows the SFCL in a person who produces crops circuit. Individual comedian who sets up joke supplies, that is troublesome to oust, such as secret cables or disposal switchgear, can be shielded for one SFCL.

Figure 3(c) shows the SFCL joining two busbars. The busbars are only separated for one SFCL all along a fault (Xueguang W., Joseph M., Scratch J. and Goran S., 2003).

SFCL Performance: Modeling

A record of what happened established a usual substation has existed thought-out. Few of the key limits concerning this scheme at an aggregate level are summed up in Table 1. A total of five cases of studies including five various portion increase of ZFCL. Consumed the five, singular of it is depicted as proved in figure 4(b) beneath.4(b) below.

Table 1 Summary of Test System Steady-State Parameters



Parameter Description	Value	Unit
System Voltage	33	kV
Substation Transformer	132/33	kV
Nominal Frequency	50	Hz
Transformer Short-Circuit Power	40	MVA
Source Short-Circuit Power	2400	MVA
Fault Impedance	1×10^{-6}	Ω
Internal Impedance	0.75	Ω
Load Impedance	15	Ω
Superconductor Critical Temperature	77	K
SFCL Phase wire diameter	0.08	m
SFCL Phase wire length	100	m
SFCL Critical current rating/phase	8.9	kA

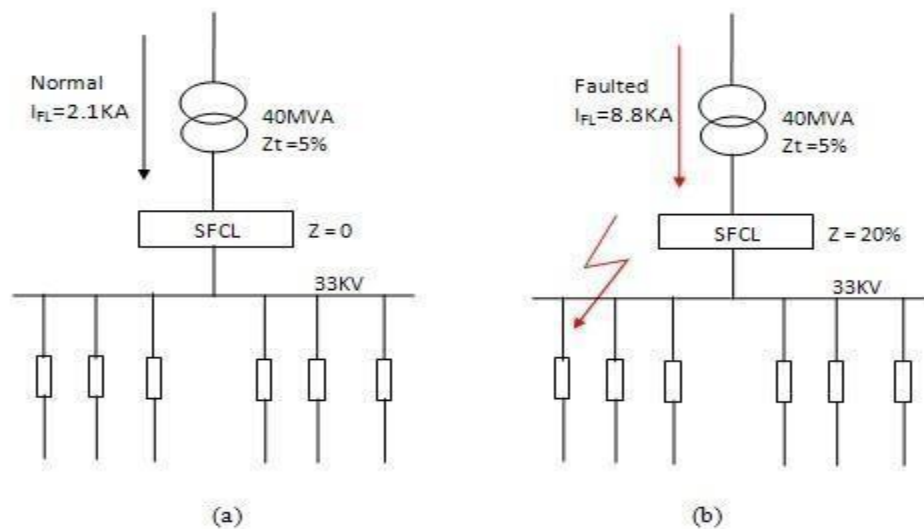


Figure 4 (a&b) Fault current controls with and without a SFCL

Results and discussion

Powerworld person who pretends to be an expert was picked to design and implement the Resistant SFCL model. In Figure 4.1, a abundant, reduced-resistance engine ($Z_t=5\%$) is used to feed a busbar. The SFCL is equipped betwixt the generator and the busbar for confining the sin current. Usually, the SFCL does not influence the boundary, and the thorough-load current I_{FL} is 2.1kA. All the while a blame, the SFCL cultivates an resistance of 0.2 apiece ($Z=20\%$), and the mistake current I_{SC} is weakened to 8.8kA. Outside the SFCL, the mistake current hopeful 44kA. The adaptation of ZFCL depends on the amount of mistake that happen vulnerable and allure distance to from point place the ZFCL is situated. Each of these principles are figured in Table 2, for the unchanging Blame current. It is visualized that as the portion principles of the word modifying a verb increases, the sin current decreases. This is further pictorial in the diagram in Figure 5. Table 2 Weakness current principles accompanying and outside SFCL for various allotment increase of Z_{FCL} (Thomas, J. O., 2013)

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