A COMPREHENSIVE ANALYSIS OF DISTANCE MODELLING FOR COMPENSATED TRANSMISSION LINE

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Abstract: In this paper the approach that has been created for the study of a transmission line in which the distributed line parameters per unit length are non-constant. In this paper we investigate the transmission line with the inhomogeneous distributed characteristics. And the transmission line is infinitesimal line. Here is a technique for the analysis of non-uniform transmission line by applying the perturbation method. The starting point for the procedure is the KCL and KVL of the line for the infinitesimal line length. These lead to force a system of the coupled first order linear differential equations for the voltage and current along the line. These differential equations have non constant coefficient in view of the in homogeneity of the line. For implementation of perturbation theoretical method, we start with the original system of coupled differential equations is expended in state variables from with the state vector being the voltage and current variables along the line and deriving 2×2 matrix being built out of the distributed parameters. This paper transmission Line on sends the Different parameter of voltage and current and ultimate aim to study and implement the research for Distance Modelling for Compensated Transmission Line.

KeyWord: KCL, KVL, Transmission Line, Distance Modellin

I. INTRODUCTION

An engineer's duty while switching from an uncompensated power transmission line to one that has been compensated is to adjust to the changes that have been introduced by the compensation devices. The power system has become the most complicated system ever developed as demand for electricity continues to rise. Proper protection systems are required for all power apparatuses due to the enormous amount of money invested on the construction of the power system. The rising demand for electricity leads to a rapid expansion of the transmission system and an increase in the amount of power that must be transferred before the transmission line reaches its thermal limit. Series compensation will be installed on long EHV transmission lines as a result of this. Increased power transfer capacity, improved system transient stability, voltage control, power flow management and reduced losses are all benefits of the series compensation. Fixed capacitor series compensation and adjustable capacitor series compensation are two of the most common methods of series compensation. End-line compensation and mid-line compensation are employed in practice depending on the location of the compensating device on the circuit.

Understanding the influence of series compensation on protection is essential to designing acceptable systems for utility networks employing series capacitors. For high-power EHV transmission lines, distance relays are often used for protection purposes, and compensation is typically implemented in a transmission system. A distance relay uses real-time measurements and fault type information to calculate the line's impedance in real time. The impedance of a series compensated transmission line is affected by the addition of a compensating device. Because of this, the location of the fault with regard to the compensator (fault zone) is necessary for a distance relay to make its final judgement. Single-pole tripping is made possible by faulty phase selection, which improves system stability and availability. Transient stability and switching overvoltage in the system will be improved as a result.

1.1 Transmission line

An electromagnetic transmission line is a kind of cable or other structure that is specifically built to transmit electromagnetic waves. It's referred to when the length of the conductors necessitates consideration of wave nature. The small wavelengths used in radio-frequency engineering imply that wave phenomena may occur over extremely short distances, making this a particularly relevant consideration (this can be as short as millimeters depending on frequency). When it comes to long-distance telegraph lines, such as undersea cables, the idea of transmission lines was first devised to explain occurrences. Transmitting lines are used for a variety of applications, including spreading cable television signals, transmitting phone calls between switching centers, and transmitting high-speed data over computer network connections and high-speed computer data buses. There are several ways to design circuits using RF transmission lines, including using printed planar transmission lines and arranging them in certain patterns. distributed-element circuits are an alternative to typical circuits that use discrete capacitor and inductor components.

Low-frequency alternating current (AC) and audio signals may be carried using standard electrical wires. Radio frequency currents beyond 30 kHz cannot be carried by these cables due to the energy being radiated off the cable as radio waves, resulting in power losses. Connectors and junctions in the cable also reflect RF currents, which go back to the source. It is impossible for the signal power to reach its final destination because of these reflections. Transmission lines are constructed with particular impedance matching and specialized construction in order to minimize electromagnetic signal reflections and losses. The characteristic impedance of most transmission lines is that they have a consistent cross-sectional size over their length, which prevents reflections. If a cable or media has a high enough frequency, the wavelength of electromagnetic waves travelling through it will be shorter than normal. Short wavelengths need transmission lines, since the cable length becomes a substantial component of the wavelength. To reduce power losses, waveguides are utilized instead of transmission lines at microwave frequencies and higher, which act as "pipes" to contain and direct waves. Optical technologies like lenses and mirrors are used to steer electromagnetic waves at even higher frequencies, such as the terahertz, infrared and visible ranges.

1.2 Compensation in Power System

An Overview of the Compensation Process in the Power System - The vast majority of the world's electric power networks are still linked. This is done for the purposes of lowering costs and improving dependability. Interconnections make use of the various loads, the availability of sources, and the cost of fuel in order to provide loads with electricity at the lowest possible cost and with the least amount of pollution while yet meeting the requisite level of dependability. When it comes to maintaining a stable competitive environment for the provision of electric service, a functional electric grid is absolutely necessary in a deregulated environment for the electric service industry.

These days, a bigger demand has been put on the transmission network, and it is expected that this need will continue to rise as a result of the growing number of generators that are not owned by utilities as well as the increased level of competition among utilities themselves. The acquisition of new rights of way is not a simple process. As a consequence of increased demands placed on transmission, a lack of long-term planning, and the need to give open access to producing businesses and consumers, there is now less supply security and a reduction in the supply's overall quality. It is for this reason that compensation in power systems is very necessary to ease some of these issues. In order to accomplish this goal throughout the course of the previous many years, series/shunt compensation has been used.

Because there is very little room for electrical storage in a power system, it is essential that the load and production of power remain in constant equilibrium. The electrical system is capable of auto-regulating itself to some degree. In the event that generation is lower than load, the voltage and frequency will fall, which will have the effect of decreasing the load. However, the room for such self-regulation is barely a few percent at best. If the voltage is maintained by means of reactive power support, then an increase in load may lead to a reduction in frequency, which may ultimately end in the collapse of the system. Alternately, if there is an insufficient amount of reactive power, the system can have a voltage collapse.

This presentation, entitled "An Introduction to Compensation in Power System," is devoted to the study of various techniques for compensating power systems as well as various types of compensating devices, which are collectively referred to as compensators. The goal of this research is to find solutions to the issues with power systems that were outlined earlier. These compensators have two different possible connections inside the system: either in series or in shunt at the line's terminals (or even in the midpoint). The following are some of the limitations placed on the loading capacity of the transmission system:

There are three different types of constraints that may be placed on the loading capacity of a transmission system:

1. Thermal
2. Dielectric
3. Stability

The thermal capacity of an overhead line is dependent on the temperature of the surrounding air, the direction and strength of the wind, the state of the conductor, and the distance from the ground. The loading capacity of a line may potentially be increased by changing it from a single-circuit configuration to a double-circuit one. Dielectric Limitations and Restrictions Many lines are constructed quite conservatively, particularly with regard to their insulation. It is not uncommon to be able to raise the usual working voltages of a device by ten percent, bringing them from, say, 400 kV to 440 kV with the same nominal voltage rating. However, one should make sure that dynamic and transient overvoltage’s are contained within acceptable parameters. Problems with Stability There are certain stability concerns, which, in turn, restrict the potential of the transmission. These phenomena include steady-state stability, transient stability, dynamic stability, collapse of frequency and voltage, and sub synchronous resonance.

1.3 Compensation of the Load in the Power System:

The control of reactive power to enhance power quality, as measured by V profile and pf, is what load compensation refers to. In this configuration, the flow of reactive power is managed by putting shunt compensating devices (capacitors/reactors) at the load end, which results in a healthy equilibrium between the reactive power that is created and that which is consumed. This is the most effective method for increasing the system's capacity to transmit power and enhancing the voltage stability of the system. Operating the system such that the power factor is as close to one as possible is desirable from both an economic and a technical standpoint. This is the reason why some utilities impose a fee on customers with low pf loads. In order to improve the performance of the system under still another manner, you may run it in circumstances that are almost balanced. This will cut down on the flow of negative sequence currents, which will ultimately lead to an increase in the system's load capacity and a decrease in power loss.

There are three types of critical loadings for a transmission line.

- Natural loading
- The limit on the steady-state stability and
- Loads at the thermal limit.

The natural loading on a compensated line is the lowest, and the steady-state stability limit is obtained at before the thermal loading limit is reached.

Line Compensation in Power Systems: Line Compensation - Line Compensation in Power Systems The ideal voltage profile for a transmission line is flat, which is something that can only be accomplished by loading the line with its surge impedance loading. While this may not be possible, the characteristics of the line can be modified by line compensators so that the ideal voltage profile can be achieved.

- The Ferranti effect is reduced to a minimum
- It is not necessary to run synchronous generators with the under excited operating mode.
- The capacity of the line to transmit electricity is improved after the upgrade. Line compensation refers to the process of modifying the properties of a line or lines.

The following are some of the compensatory devices:

- Capacitors
- Electromechanical capacitors and inductors
- A source of voltage that is active (synchronous generator)

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t is referred to as a bank of capacitors when a number of capacitors are linked in parallel to acquire the appropriate capacitance, and it is referred to as a bank of inductors when several inductors are connected in parallel. Switching allows for incremental adjustments to be made to a bank of capacitors and/or inductors (mechanical). The terms "passive line compensators" refer to capacitors and inductors in and of themselves, whereas "active line compensators" refer to synchronous generators. Active compensation is the process that takes place whenever solid-state electronics are used for the purpose of switching off capacitors and inductors. Before moving on to the more in-depth explanation of the line compensator, we are going to have a quick conversation on both shunt and series compensation.

Shunt compensation may be thought of as being analogous to load compensation, complete with all of the benefits that come along with it. It is imperative that this point be emphasized because shunt capacitors and inductors cannot be placed in a consistent fashion throughout the line. Typically, they are linked at the terminal end of the line or at the point exactly in the middle of the line.

Because shunt capacitors enhance the load pf, the line does not need to carry the reactive power, which results in a significant increase in the amount of power that can be transferred across the line. It is possible to increase the power that is transferred by shunt compensation, but only up to a certain point since doing so would need a capacitor bank of a very high size, which would be impractical. There are additional and superior methods that may be used to increase the amount of electricity that is transferred down the line. As an illustration, series compensation, increased transmission voltage, HVDC, and so on are all examples.

When switched capacitors are used for compensation, it is important to disconnect them as soon as possible whenever there is a light load. This will help prevent an excessive increase in voltage as well as ferro resonance when transformers are present. Through the use of series capacitors, the series inductive reactance of the line is partially nullified so that series compensation may fulfil its function. This assists in (i) increasing the maximum amount of power that can be transferred, (ii) decreasing the power angle for a certain amount of power that can be transferred, and (iii) loading more. It is preferable, from a purely practical standpoint, to keep the total amount of series compensation below or at 80 percent. If the line is compensated one hundred percent, it will act as if it were a resistive element in its whole and will generate series resonance even at the fundamental frequency. Economic considerations and the intensity of the fault currents play a role in determining the placement of series capacitors. A capacitor connected in series lowers the line reactance and, as a result, the amount of fault currents.

II. LITERATURE REVIEW

Tabari & Sadeh (2022), fundamental ANFIS was designed via subtractive clustering. Various situations have been examined, including two distinct ANFIS configurations, one for the full line and one for each segment of the line, in this research. Furthermore, the Relief method has been used to evaluate the effectiveness of feature selection. In a test transmission system, several training patterns and tests have been supplied for diverse system circumstances, such as varied fault inception angles, fault locations, fault resistances, and structural conditions. Under a broad variety of system modifications, the findings show that the suggested technique successfully detected the problem.

Rahmani-Andebili (2022), The transmission line model and performance issues are discussed in detail in this paper. Transmission line models, transmission line voltage control, transmission line compensation, and transmission matrix characteristics are among the topics covered. There are three degrees of difficulty in this chapter: easy, normal, and hard, and the calculating amounts for each issue are divided into three categories (small, normal, and large). In addition, the tasks are arranged from the simplest to the most challenging, based on the number of computations required.

Zheng et al. (2022), This work presents a fault detection system based on the active injection of the characteristic voltage by the control of the UPFC in order to tackle this challenge. When both sides of a bad line have tripped their circuit breakers, it's time to move over to extra control mode on UPFC's series converter. Series transformers are used to actively inject the line's typical voltage.

Pojadas & Abundo (2022), this article presents a four-stage energy modelling methodology for the location of VRE farms utilising GIS and CBA. Finding acceptable locations and assessing the spatio-technical inputs are the first three phases of using an established framework. The feasibility of VRE technologies is analyzed using the benefit-cost ratio in the fourth step of the CBA.

Taheri et al. (2022), This research thus proposes a novel approach for the estimate of source impedance and other network properties, which are crucial elements for the precise calculation of the fault location, based on Long Short-Term Memory (LSTM) networks. PSCAD and Python software are used to run the simulations on a two-circuit network. Wind farm, synchronous generator, and two parallel lines make up the network's power source. The DFIG model is used to represent the wind farm in the network examined. The test results show that the suggested approach may be used to accurately predict the location of the fault and the impedance of the source. The findings acquired from the testing.

Nasab et al. (2022), There is already a viable and cost-effective way to enhance transmission capacity while also improving transient and long-term stability in AC transmission systems by using series compensators. clients with important loads, since the energy market has become more competitive as a result of private sector ownership. For transmission and distribution networks, it has led to the development of faster and more reliable ways for finding faults. It might be tough to find the problem. There are a number of ways to locate compensated lines in series. A new A Hybrid Scheme approach for compensating series compensated lines using Thyristor Controlled Capacitor Compensator is presented in this study (TCSC). Fault detection on transmission lines with series compensators is potentially possible using the suggested technique. Time domain model and distributed transmission line model are used in this approach. Regardless of where the series compensator is located, it can identify the kind and direction of the fault in the smallest amount of time in addition to the location of the fault. MATLAB software was used to simulate the simulation and model the suggested approach. As a consequence of these experiments, it has been shown that the suggested method improves accuracy while also speeding up the identification of the fault site in series compensated transmission lines.

Cao et al. (2022), Bessel-based compensation is compared to natural HWTL and Tuned HWTL using Butterworth filter-based and conventional compensation circuits. To verify that Bessel-based compensation circuits have a voltage distribution comparable to typical compensation circuits, extensive instances are simulated using PSCAD. The high-frequency oscillation of tuned HWTL may be greatly decreased using Bessel-based compensation circuits, compared to typical compensation circuits, which can cause considerable high-frequency oscillations. This means that tuning HWTL using a Bessel-based compensation circuit is the best option.

Li, X., Lei, C., Yu, H., & Feng, Y. (2022), Due to the severe underwater photography conditions, the photos acquired underwater have poor contrast and colour distortion. This study presents a colour compensation and color-line model-based underwater picture restoration technique. One approach offered to correct for attenuated colours and enhance colour line estimates is a colour compensation method. In the second place, the link between three-channel transmission and global background light is derived from this correlation. Using the colour line rule, an optimization model for underwater image transmission is developed to generate a local transmission map. To finish, the simplified imaging model is reversed and used to create the restoration pictures in the last step. Subjective and objective evaluations, colour accuracy testing, and application evaluations all reveal that their technology outperforms the competition. An advantage of this technique is the increased colour integrity and increased clarity of the photographs.

Jagadeesh Kumar et al. (2022), Linearly, the demand for electricity and the amount of money lost in the transmission sector are growing. Transmission lines are experiencing voltage fluctuation owing to an increase in the utilization of nonlinear loads. The sag, swell, voltage spikes, harmonics, open and short circuit faults are some of the issues. Swell and sag are two of the most serious problems with power quality, and the interline dynamic voltage restorer may help fix them (IDVR). As long as IDVR is able to execute voltage compensation at a sufficient pace, it provides a constant energy supply across the DC link capacitance. Several DVRs linked to different distribution feeders in the electrical system may share a common energy storage, according to this strategy. When DVR needs correction, a SMES is used to provide power to the superconducting magnetic energy storage system (SMES). Additionally, fuzzy logic control was included. The suggested method's efficiency and performance are shown in the Simulink results.

Saad, M., & Kim, C. H. (2022), For shunt-compensated extra-high-voltage transmission lines, this research presents a unique adaptive reclosing method with two stages. First, a criterion for measuring the exact moment of secondary arc extinction is devised, called the SAEPC (Secondary Arc Extinction Peak-Based Criteria). The method is based on the estimated weighted lower-order harmonics and the size of the defective phase voltage. In the second step of fault classification, the harmonics root mean square factor (HRF) is reported, i.e., temporary or permanent. The suggested method not only detects the quenching moment but also recognizes the kind of fault, independent of fault location, compensation level, or arc extinction speed. It has been shown that the suggested method is able to overcome the restrictions of current single-criterion harmonics-based reclosing methods.

III. RESEARCH METHODOLOGY

Analysis of Non-Uniform transmission line is done by two given methods.
3.1 Discretization of Non-Uniform Transmission line.
3.2 Perturbation Theory of Non uniform Transmission line.

3.1DISCRETIZATION OF NON-UNIFORM TRANSMISSION LINE

Figure 3.1, shows the basic differential equations governing the voltage and current along a transmission line that’s distributed parameters R, L, G and C which are varying along the line. The differential equations of non-uniform transmissions line are given in equations (3.1) and (3.2)

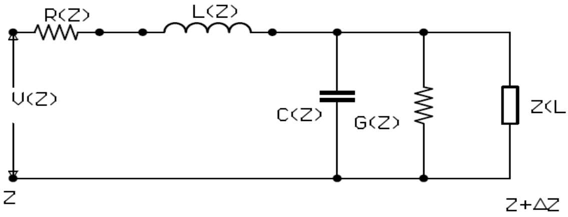

Figure 3.1: Discretization model of non-uniform transmission line

$$-\frac{dV(z)}{dz} = (R(z) + j\omega L(z)I(z) \quad 3.1.$$

$$-\frac{dI(z)}{dz} = (G(z) + j\omega C(z)V(z) \quad 3.2.$$

From equation (3.1.)

$$I(Z) = -\frac{V'(z)}{R(Z)+J\omega L(Z)} \quad 3.3$$

Substituting (3.3) into equation (3.2)

$$\frac{d}{dz}\left(\frac{V'(z)}{R(Z)+J\omega L(Z)}\right) = \big(G(Z) + J\omega C(Z)\big)V(Z) \quad 3.4$$

$$\left(\frac{V'(z)}{R(Z)+J\omega L(Z)}\right) - \left(\frac{R'(Z)+j\omega L'(Z)}{\left(R(Z)+J\omega L(Z)\right)}V'(z) - \big(G(z) + j\omega L(z)\big) = 0 \quad 3.5$$

Now we will calculate v’ (z)

Where,

$$\lambda^2 = ((G(z) + J\omega C(z)(R(z) + J\omega L(z)) \quad 3.7$$

Where

$$\lambda^2 = \text{Function of z}$$

Let

$$A(z) = \left(\frac{R'(Z)+j\omega L'(Z)}{\left(R(Z)+J\omega L(Z)\right)}\right.$$

$$B(z) = \lambda^2$$

Where

$$R(z) = R_0 + R_1\sin(\beta z) \quad 3.8$$

$$L(z) = L_0 + L_1\sin\left(\beta z + \frac{\pi}{6}\right) \quad 3.9$$

$$C(z) = C_0 + C_1\sin\left(\beta z - \frac{\pi}{6}\right) \quad 3.10$$

$$G(z) = G_0 + G_1\sin(\beta z) \quad 3.11$$

Where

$$\beta = \frac{2\pi}{\lambda}, R_1 = \frac{R_0}{2}, L_1 = \frac{L_0}{2}, G_1 = \frac{G_0}{2}, C_1 = \frac{C_0}{2}$$

$$1 \le n \le 100$$

$\boldsymbol{\lambda}$=1/10

Discretize Equation (3.12) with step size Δ

Where z=nΔ

n=0,1, 2…………………………….N-1

NΔ=d

$$\Delta = \frac{1}{100}$$

After this Discretization, this second order differential becomes a second order difference equation.

Initially condition $V_o=1$

Final condition (load) $V_n = Z< load >.I(d)$

Thereafter we can calculate I_d and V_n values for values of $\boldsymbol{\lambda}$.

3.2 PERTURBATION THEORY OF NON-UNIFORM TRANSMISSION LINE

Perturbation theory is applied to the solution of inhomogeneous transmission line equations. These line equations are

$$-v_{,z} = L(z)i_{,t} + R(z)i$$
$$-i_{,z} = C(z)v_{,t} + G(z)v$$

Where R (z), L (z), C (z), G (z) is the distributed parameters of the line. We assume that these distributed parameters have a strong constant part and a constant weak varying part.

$$R(z) = R_o + \epsilon.R_1(z)$$
$$L(z) = L_o + \epsilon.L_1(z)$$
$$G(z) = G_o + \epsilon.G_1(z)$$
$$C(z) = C_o + \epsilon.C_1(z)$$

Assume constant frequency ω. Then the line current and voltage phasor I (z), V (z) satisfy.

$$-V' = (R + j\omega L)I$$
$$-I' = (G + j\omega C)V$$

Or in matrix notation

$$-\frac{d}{dz}\begin{pmatrix}V(z)\\I(z)\end{pmatrix} = \begin{pmatrix}0 & R(z) + j\omega L(z)\\G(z) + j\omega C(z) & 0\end{pmatrix}\begin{pmatrix}V(z)\\I(z)\end{pmatrix}$$

We can write

$$A(z) = \begin{pmatrix}0 & R(z) + j\omega L(z)\\0 & G(z) + j\omega C(z)\end{pmatrix}$$
$$= A_0 + \epsilon A_1(z)$$

Where,

$$A_o = \begin{pmatrix}0 & R_o + j\omega L_o\\G_o + j\omega C_o & 0\end{pmatrix}$$
$$A_1(z) = \begin{pmatrix}0 & R_1(z) + j\omega L_1(z)\\G_1(z) + j\omega C_1(z) & 0\end{pmatrix}$$

Is a slowly varying matrix. We expend the solution in power of ϵ, i.e.

$$\begin{pmatrix}V(z)\\I(z)\end{pmatrix} = \sum_{n=0}^{\infty}\varepsilon^n\begin{pmatrix}V_n(z)\\I_n(z)\end{pmatrix}$$

Substituting this in to the governing differential equations with the notation $X_n(z) = (V_n(z), I_n(z))^T$ and equating equal powers of ϵ gives

$$X_0'(z) = A_o X_0(z)$$
$$X_n'(z) = A_o X_n(z) + A_1(z)X_{n-1}(z), n = 0,1,2 \dots\dots$$

The solution is

$$X_o(z) = exp(zA_o)\, X_o(z)$$

$$X_n(z) = \int_0^z exp((z-u)\,A_0)A_1(u)X_{n-1}(u)du, n \geq 1$$

Iterating this scheme we get

$$X_n(z) = \left(\int_{0<u_n<u_{n-1}<..<u_1<z} \varphi(z-u_1)A_1(u)\varphi(u_1 - u_2)A_2(u)\dots\dots\varphi(u_{n-1} - u_1)A_1(u_n)\varphi(u_n)du_n du_{n-1}\dots..du_1\right)X(0)$$

Where, $\varphi(z) = exp(zA_0)$, suppose that we have solved the problem up-to $0(\varepsilon^n)$. This approximate solution can be written as

$$X(z) \approx \Psi_n(z)X(0)$$

Where

$$\Psi_N(z) = I + \sum_{n=1}^{N} \varepsilon^N \left(\int_{0<u_n<u_{n-1}<..<u_1<z} \varphi(z - u_1)A_1(u_1)\dots\varphi(u_{n-1} - u_1)A_1(u_n)\varphi(u_n)du_n du_{n-1}\dots..du_1\right)$$

The 2×2 matrices $\Psi_N(z)$for various values of zϵ[0,d] are computed by approximating the multiple integrals with discrete sums. For example,

$$\Psi_N(k) \approx I + \sum_{n=1}^{N} \varepsilon^N \Delta^n \left(\int_{0<k_n<k_{n-1}<..<k_1<k} \varphi(k - k_1)A_1(k_1)\dots\varphi(k_{n-1} - k_n)A_1(k_n)\varphi(k_n)\right)$$

Where Δ= (d|k) and. In other words, the entire length has been divided into K equal's part and the k=0,1 ,2,3……………k-1 multiple integrals have been replaced by a multiple sum.

Where, $Z = n\Delta$

$$N = 0,1,2 \dots\dots\dots\dots\dots\dots\dots N - 1$$

$$N\Delta = d, \Delta = 1 \div 100$$

$$R_1(z) = \sin(\left(\left(2 * \pi * \frac{n}{100}\right)\right)$$

$$L_1(z) = \sin(((2 * \pi * n)/(100 + \frac{x}{y})$$

$$C_1(z) = \sin(((2 * \pi * n)/(100 - \frac{x}{y})$$

IV. MODELING FOR TRANSMISSION LINE

A transmission line can be represented as a two-port circuit using ABCD parameters which determine the relationship between voltage and currents in sending and receiving ends. The accurate representation of an actual transmission line may be done only in terms of uniformly distributed parameters r (series resistance), l (series inductance), and c (shunt capacitance). For short lines (less than 80 km) and medium lines (between Power flow or load flow in an ac power system deals with the calculation of bus voltages and their phase angles as well as the flow of active and reactive power through various network elements under steady-state conditions. This provides a systematic mathematical approach, which is an essential source of engineering information for planning, design, and operation, as well as an important tool for several other fields of power system analysis such as stability, symmetrical and asymmetrical faults, and system harmonic studies.

In power systems, generators are usually treated Up to now, we have studied the power system under normal operating conditions. Any failure in a power system which causes short circuit of a section is called a fault. This short circuit creates a low-impedance path through which fault currents greater than normal condition can flow. As these fault current magnitudes can be several times larger than normal, they may cause damage to the power system equipment. These damages could be categorized as electrical and mechanical. From the electrical view point, excessive current flow may cause thermal damage to solid insulation or metallurgical damage to conduct an unsymmetrical or asymmetrical fault is defined as a fault that affects one or two phases of a three-phase system in contrast with the previously studied balanced or symmetrical faults which equally affect each of the three phases. Unsymmetrical faults constitute more than 95 percent of all faults occurring on a transmission line. Although this type of fault involves lower fault current magnitude than symmetrical faults, its study is particularly important with regard to system stability considerations, relay setting, and single-phase switching. As well, current flow into the ground from unsymmetrical faults can affect Control of voltage and power flow is one of the essential and important tasks in power system management, particularly for modern power systems with a large number of components and interconnections for ensuring power quality and reducing losses.

In addition to maintaining voltage at all buses within an admissible range and to increasing transmission line power transfer, control of voltage and power flow aims at improving the system stability and economic operation. There is a strong dependency between active power flow (P) and voltage angle (δ) on the one hand, and reactive Control of voltage and power flow is one of the essential and important tasks in power system management, particularly for modern power systems with a large number of components and interconnections for ensuring power quality and reducing losses. In addition to maintaining voltage at all buses within an admissible range and to increasing transmission line power transfer, control of voltage and power flow aims at improving the system stability and economic operation. There is a strong dependency between active power flow (P) and voltage angle (δ) on the one hand, and reactive from engineering viewpoint stability is the ability of a system to return to its steady-state condition after being subjected to a disturbance. Stability for a synchronous machine in a power network refers to recovering its synchronous speed after having been subjected to a disturbance due to changes in the input or output power. Power system stability refers to maintaining the synchronism between the various parts of a power system. Stability considerations are recognized as major concerns in power system planning and studies.

V. SIMULATION PARAMETER

Three-Phase Source
Rms voltage - 250e3
Frequency – 50Hz

Three-Phase Series RLC Branch
Resistance 6
Inductance – 0.053H

Three phase Load
Active power -304.8e6
Inductive power - 228.6e6

Simulation Layout

Fig 5.1: Basic layout designed in MATLAB 2013a that contains two buttons. Earlier is for perturbation theory and proposed is for modeling of transmission line.

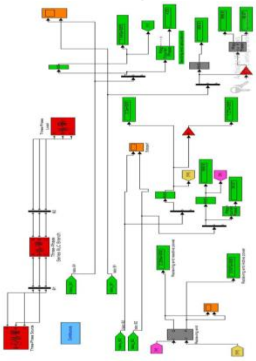

Fig 5.2: Simulation of Transmission line using MATLAB

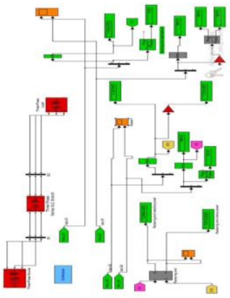

Fig 5.3: Simulation in running time (Green Box shows the timer) for transmission behavior

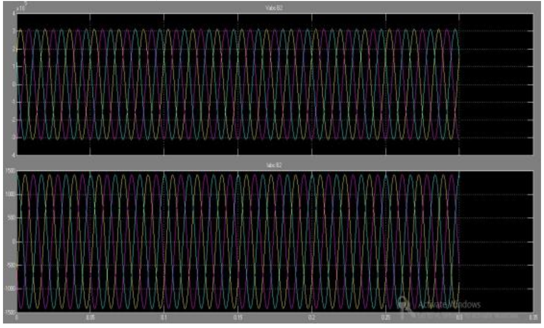

Fig 5.4: Output of scope 1(Sending End of transmission Line)

Fig 5.5: Output of scope 2(Sending End of transmission Line_on sends the Different parameter of voltage and current)

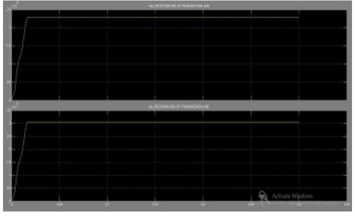

Fig 5.6: Output of scope 3 (Receiving End of transmission Line)

The simulated output finds in the three different scopes that is in MDL file of Simulink. One is on the side of sending end, second find the same end but with different parameter of inputs and the last one is on the receiving end of transmission line.

CONCLUSION AND FUTURE SCOPE

In this paper the technique that has been developed for the analysis of a transmission line in which the distributed line parameters per unit length are non-constant. In this paper we consider the transmission line having the inhomogeneous distributed parameters. And the transmission line is infinitesimal line. Here is a method for the analysis of non-uniform transmission line by using the perturbation method. The starting point for the method is the KCL and KVL of the line for the infinitesimal line length. These lead to force a system of the coupled first order linear differential equations for the voltage and current along the line. These differential equations have non constant coefficient in view of the in homogeneity of the line. For implementation of perturbation theoretical method, we start with the original system of coupled differential equations is expended in state variables from with the state vector being the voltage and current variables along the line and deriving 2×2 matrix being built out of the distributed parameters. This matrix is decomposed into the sum of a constant 2×2 matrix and a varying 2×2 of the parameters; we arrive at a sequence of linear differential equations for each order. Matrix assumed to have small norm which guarantees the applicability of the perturbation theory. A small parameter attached to the varying part and the state vector is expended as a power series in this parameter. By equating coefficient of each power of the parameters, we arrive at a sequence of linear differential equations for each order. The final solution is a Dyson series for the state vector and the convergence is rapid provided the amplitudes of the varying part of the distributed parameters are small. In this paper several cases have been discussed to see the effectiveness of the proposed analysis. It is observed that the case no 2 shows the three-dimensional plot of voltage phasor as a function of both the variable frequency and distance from the source end having the condition R0=1, L0=1, C0=1, G0=1.Therefore such transmission line is always preferable for frequency range of above 20. In another case no.4 it is observed that three dimensional plot of the voltage phasor as a function of both the variables frequency and distance from the source end having the constant part values R0=1, L0=0.01, C0=1, G0=1. This represent that the voltage strength in the whole normalized distance. Also case no 5 shows the two-dimensional plot of voltage phasor as a function of distance from the source end for different fixed frequencies for ω=10, 25, 1, 50, 75, 100. Constant part having values as same in case no.1 and no change in varying part of primary constant. This type of transmission line can be used for high frequencies systems. In summary, the successful approximation using the perturbation method is achieved provided the amplitudes of the distributed parameters are not too large. The most far-reaching generalization of the work is carried out in this paper is the following. The distributed parameters along the line are nonlinear function of voltage and current histories up to time t. Models for these dependencies can be obtained by considering the B-H hysteresis curve which gives the inductance as a functional of the past current values.

By considering ohmic heating of the resistances cause the temperature changes in the resistances there by affecting the resistance values. Since ohmic temperature increment depends on the past i2(t) values it follows that the resistance is also functional or the past current values. The transmission line equations then become a set of nonlinear integral differential equations and perturbation methods are need to be developed to solve these equations.

Non uniform Transmission lines with randomly fluctuating parameters.

In Modeling file, it is been created a short transmission line which has parameter as discussed above. It has three output graphs that have relation of voltage vs. time line and current vs. time line at send end and receiving end. It has clearly showed that the output graph of frequency becomes linear just after the simulation starts. It has clear that the transmission line has stable output and very less distortion.

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