Effect of Corona on Transmission Lines due to its linked Parameters

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Abstract
The major cause of power loss in transmission lines which is wasteful and adverse is corona on transmission lines. That effect of corona which is power loss can be calculated through the peek's formula and Preston's formula further can be simulated through MATLAB. This paper provides some basic steps to tackle the effect of corona and also their relation through MATLAB between corona parameters and loss of power due to corona.

Index terms: Corona parameters, power loss, Peeks & Preston formula, transmission line

I) Introduction:

The conductor of HVTL(high voltage transmission lines) ionized and results partial discharges when in an insulation system normal voltage exceeds a critical voltage. When the voltages become greater than the critical voltage value corona occurs but the conduction area is not that intense that cause breakdown or electrical arcing to the other area nearby to that effect of corona [1] .ozone gas is produce when corona occurs on transmission line its smells like chlorine but metallic touch in it.

The corona effect has no clear symptom before it occurs. The special belongings of corona are hissing sounds , radio interference, production of ozone that can be easily observed in high voltage transmission lines. The electric conductor can be effected by irregular shape, unstable voltages ,acidic rain (only in industrial area). The dielectric breakdown Most often occurs due to corona because it spoils the insulation but it is slow process. The effects of corona majorly studied in contrast with a Sunny day(clear weather) and rainy day. The effect of the weather conditions on corona when simulated through MATLAB.

II. Peek's formula:

In clear weather conditions corona that causes the power loss can be calculated by the Peek's formula[2].

$$P_{ufwc} = \frac{K}{\delta}(f+25)\sqrt{\frac{R}{d}}\left(\frac{V_L}{\sqrt{3}} - E_{dcv}\right)^2 L \times 10^{-5}\, KW/km/phase$$

III. Preston formula:

In clear weather condition the critical voltage is 0.8 times that of rainy condition. The determination of the corona loss can be done by the Preston formula.

$$P_{ufwc} = \frac{K}{\delta}(f+25)\sqrt{\frac{R}{d}}\left(\frac{V_L}{\sqrt{3}} - E_{dcv}\right)^2 L \times 10^{-5}\, KW/km/phase$$

IV. Corona Parameters Effects On Power Loss:

Following are the foremost corona parameters which are the main cause of power loss in transmission and distribution lines.

1. The initiation corona voltage and critical voltage:

A diagramed instigation and voltages of corona is greater from the critical voltage because its model contains the raising of electrons and includes ionization to an keyed up state through discharged and by electromagnetic waves a light is produced. Fig A shows The graph between DCV and the conductor size.

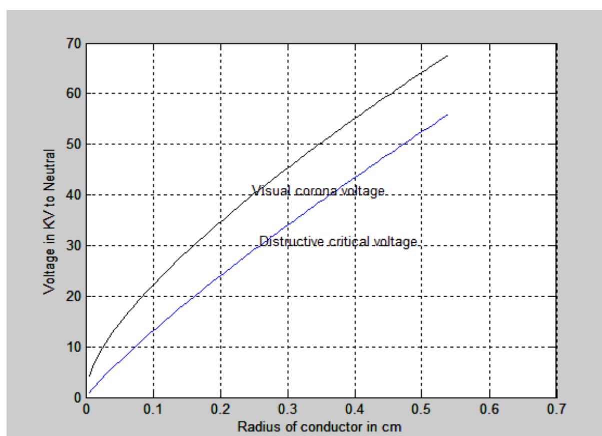

Figure A: voltages with respect to size of the conductor.

2. Temperature:

The air density rectification is important factor for the corona loss .corona loss is inversely proportional to the air density factor as the factor increases the corona decreases.

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As temperature is directly proportional to corona loss when the temperature increases at certain pressure the corona loss dominates.

3. Conductor Spacing:

Corona loss decreased as the space between the conductors increases. The designing of the spacing must be enough greater that corona can be less. Figure B shows graph between the power loss due to corona and effect of spacing on corona.

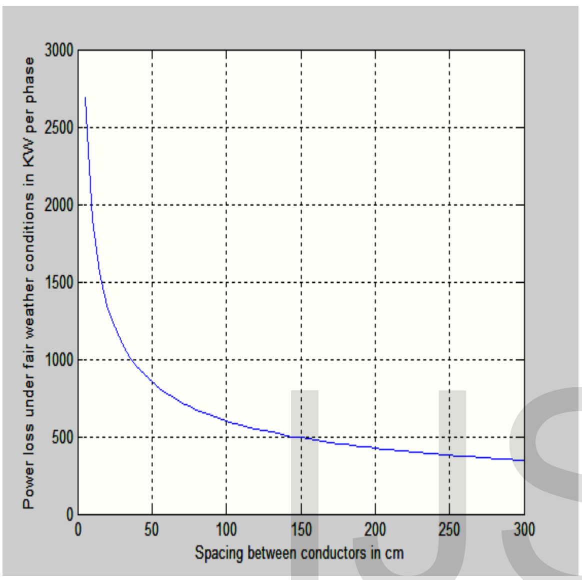

Figure B: Coronaloss and the spacing among conductors

4. The furnish frequency:

Figure C depicts that the frequency is directly propotional to the corona loss. The effect of corona is less in d.c as compared to a.c. the corona in a.c produce power loss in terms of third harmonics.

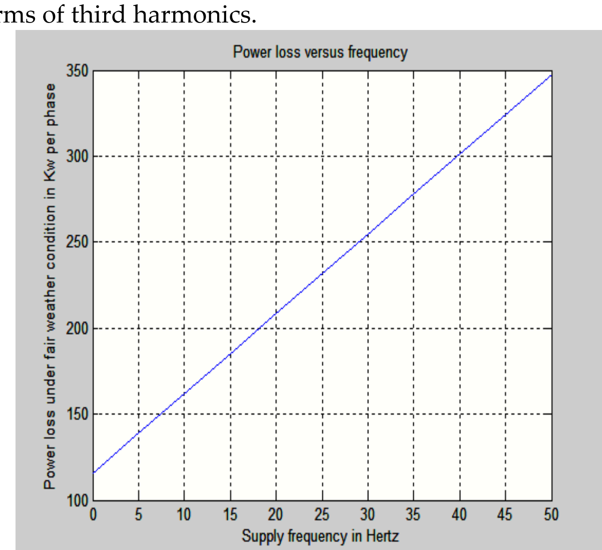

Figure C: power loss versus frequency

5. Conductor size.

The corona loss doubles as from the size of conductor Figure D depicts the corona will raise if the thickness of the conductor enhance. it also depends on the conductor Material.

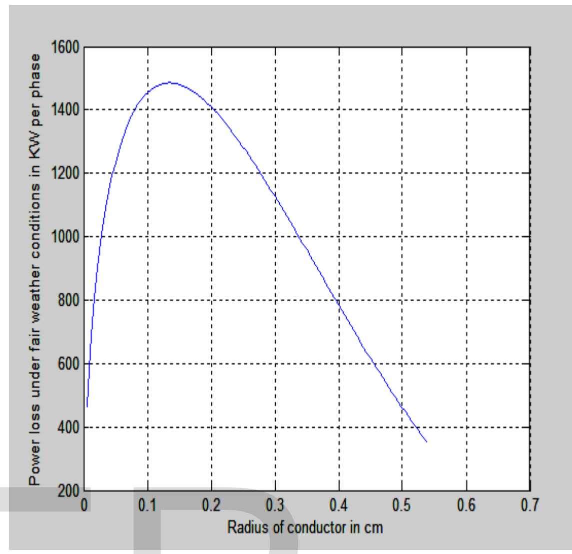

Figure D: power loss against volume of conductor

6.Transmission voltage:

When the DCV(disruptive critical voltage become greater then the transmission-line voltage the corona starts producing .the greater the voltage greater the corona loss as corona loss is directly proportional to the transmission-line voltage applied

7.Stormy(rainy) And Fair Weather Conditions:

In stormy(rainy) weather trim down disrupting voltage and magnifies the effect of the corona power loss. Figure E depicts power loss in KW(per phase) between clear and (rainy) conditions at different values of disrupting voltage. The corona inversely proportional to critical value of voltages.

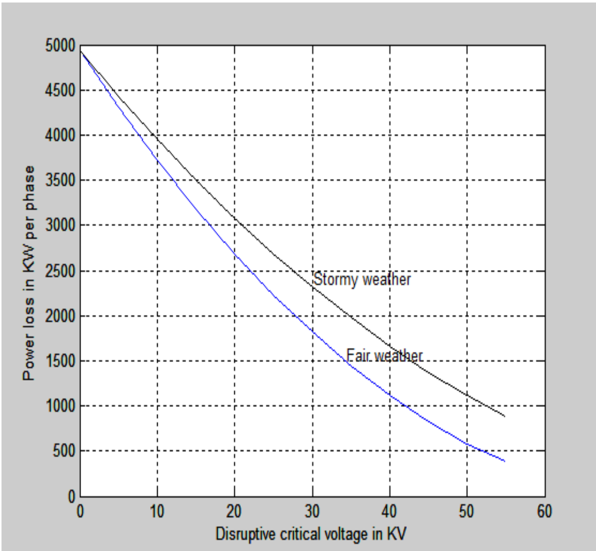

Figure E : Comparison between stormy(rainy) and fair(clear) weather

VI. Methods of decreasing corona loss:

Corona loss can be minimize by controlling the following factors

-Distance between the two conductors
-Radius of the conductors
-Air Pressure:
-Controlling Weather effects
-Frequency of supply

VII. Conclusion

From the above graphical analysis through MATLAB. it is clear that corona loss is much more dependent on the Weather conditions if the weather is wet or moisture in atmosphere the corona loss will be more but in dry atmosphere the corona will be less. The degradation of the conducting material is also the main cause of the corona loss. Underground cables which are properly insulated are not much affected by the corona..

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