Computation of Electric Field and Potential Distribution of 110kv Polymer Insulator

Sarmilaa T C

Assistant Professor, Dept. of Electrical and Electronics Engineering, Unnamalai Institute of Technology, Suba Nagar, Kovilpatti

ABSTRACT

The electric field (E-Field) and potential distribution are more important in decidingthe lifetime of the insulator. Different climate conditions and several pollution conditionslead to the deterioration and degradation of the insulator's properties, increasing the electric stress and exceeding the threshold value during long working conditions, leading to the failure of the insulator. This project mainly focuses on improving the reduction of electric stress by using different side positions of the corona ring an optimizing corona ring placement on a 110 kV AC transmission line composite insulator. The Corona ring plays a significant role in the reduction of electric stress. Analyze the performance of three different positions of the corona ring: HV and LV side, LV side, and HV side, and implement the threedifferent optimizations in the Bobyqa, Nelder-Mead, and Cobyla optimizations to achieve uniform distribution. The results show that HV-side corona ring placement significantlyreduces electric stress, and Bobyqa optimization greatly reduces electrical stress compared to other optimization techniques.

Keywords: Bobyqa, Nelder-Mead, and Cobyla optimizations

I. INTRODUCTION

1.1 INSULATOR

An electrical insulator is a device used in an electrical system to stop undesired current from flowing from its supporting points to the earth. In the electrical system, the insulator is essential. An extremely high-resistance path of an electrical insulator is one through which essentially no current can flow. The overhead wires in transmission and distribution networks are often supported by supporting towers or poles. Both the towers and the poles are securely grounded. To stop current from flowing from a conductor to earth through grounded supporting towers or poles, an insulator must be placed between the bodyof the tower or pole and the current-carrying conductors. A polymer insulator comprises an epoxy resin core with glass fiber reinforcement, rod form, and weather shelters made of silicone rubber or EPDM (Ethylene Propylene Diene Monomer). Weather shelters protect the rod-shaped core. The insulator core is shielded from the elements by weather shelters. The polymer insulator is sometimes referred to as composite since it comprises a core and weathersheds. Because of their cheaper cost, lighter weight, more design freedom, more muscular mechanical strength, superior anti-pollution performance, and fewer maintenance needs, composite insulators are now commonly utilized in electrical networks.

1.2 PROPERTIES OF INSULATOR

- It must be mechanically strong enough to carry the tension and weight of conductors.

- It must have a very high dielectric strength to withstand the voltage stresses in high voltage transmission systems.
- It must possess high Insulation Resistance to prevent leakage current to the earth.
- The insulating material must be free from unwanted impurities.
- There must not be any entrance on the surface of the electrical insulator so that themoisture or gases can enter it.
- There physical as well as electrical properties must be less effected by changing temperature.

II. TYPES OF INSULATORS USED IN OVERHEAD POWER LINES

For the successful operation of power lines, proper selection of insulators is veryessential. There are several types of overhead line insulators. Most commonly used types are

- ➢ Pin type insulators
- ➢ Suspension type insulators
- ➢ Strain insulators
- ➢ Shackle insulators

2.1 PIN TYPE INSULATORS

Pin type insulators or pin insulators are popularly used in electric distributionsystems up to 33 kV voltage level. They are secured on the cross arms of the pole to carry power lines. There is a groove on the upper end of a pin insulator for housing the conductor. Conductor wire is passed through this groove and secured by binding with the same wire as of conductor. A pin insulator is usually made from porcelain, but glass or plastic may also be usedin some cases. As pin insulators are almost always employed in open air, proper insulation while raining is also an important consideration. A wet pin insulator may provide a path for current to flow towards the pole. To overcome this problem, pin insulators are designed with rain sheds or petticoats. Beyond operating voltage of 33kV, pin insulators become too bulky and uneconomical.

2.2 SUSPENSION INSULATORS

As it is already mentioned above, pin insulators become too bulky an uneconomical beyond 33 kV. So, for voltages higher than 33 kV, suspension insulators are used. A suspension insulator consists of a number of porcelain discs connected to each other with metal links in the form of a string. Line conductor is suspended at the bottom end of the suspension string which is secured to cross-arm of the tower. Each disc in a suspension insulator string is designed for a low voltage, say 11 kV. The number of discs in a string depends on the working voltage. Suspension insulators are preferred for transmission lines.

2.3 STRAIN INSULATORS

At a dead end of a transmission line or at a corner or sharp curve, the transmissionline is subjected to a great tensile load. In order to sustain this great tension, strain insulators are used at dead ends or sharp corners. For high voltage transmission lines, stain insulator consists of an assembly of suspension insulators. In this case, the suspension string is arranged horizontally and the insulator discs are in vertical plane. Two or more suspension strings can be assembled in parallel to sustain greater tensions. For low voltage lines (lessthan 11 kV), shackle insulators are used as strain insulators.

2.4 SHACKLE INSULATORS

Shackle insulators are used in low voltage distribution lines as strain insulators. A shackle insulator can be used vertically as well as horizontally and it can be directly fixed to apole with a bolt or to the cross arm. However, the use of such insulators is decreasing after increasing the use of underground cables for distribution purpose.

III. SIMULATION PACKAGE

3.1 FINITE ELEMENT METHOD

In the case of not distributing the voltage evenly and increasing E-field stress, an interruption occurs normal working power system. So much more important analysis of voltage distribution and E-field distribution. In real-time high voltage transmission line potential distribution and E-field stress analysis are much more complex and much more timetaken, so its moves for real-time finite element method simulation software. It’s a very less time-consuming process and easy to analyze real-time problems. In a practical case, the electrical field intensity is taken as (E), E-field density is taken as (D), an electric potential is taken as (V) and finally.

$$E = -\nabla V \tag{3.1}$$

Electro energy density for

$$W = \frac{1}{2}\varepsilon E^2 \tag{3.2}$$

Uniform field in the differential volume

$dw =^{1} \varepsilon(-\nabla \underline{v})^{2}$
2 (3.3)
Potential ~~at a~~ point

$$V = \frac{\varepsilon}{4\triangle_e}[c]_e[v]_e \quad (3.4)$$

The fundamental principle of the finite element approach is "divide and combine," where "division" is done for element analysis and "combine" is done for integal structure synthesis evaluation. The initial model is made up of all elements joined by nodes.

The electrical parameters for each element must be established by the various properties of the materials linked to the model. The Maxwell equations and boundary conditions simplify all constituent parts appropriately, coupled with their original structures, to produce finite element equations. Using the given character as a guide, the correct calculation method is applied to determine the physical field quantity of unknown nodes.

3.2 ELECTRIC STRESS

In modern times, composite insulators are gradually increasing, and the effects of different climatic conditions cause electric stress, which leads to flashovers. Environmental stress is not under control, but electric stress reduction techniques are available. One such technique is the corona ring. The effective way to use the Corona ring is an easy way to distribute the E-field and electric potential evenly. Analyzing the E-field distribution and howit affects the insulator allows one to assess its performance. The E-field distribution of composite insulators is influenced by the applied voltage, insulator design, tower layout, corona ring, hardware design, phase spacing, etc. The grounded and energized ends of the composite insulators often have very high E-field values. High E-field strengths can cause electromagnetic pollution, including partial discharge, corona discharge around the insulator surface, loud noise, radio interference, and premature insulation ageing. By avoiding or minimizing the electrical stress in the composite insulator, keeping the electric stress value below the essential levels will assist in managing the electric stress on composite insulators and improve electrical performance.

3.3 STRUCTURE AND MATERIALS

In recent years, silicone and ethylene-propylene rubber (EPM) has been widely used as insulating materials. Among these, silicone rubber's the most UV radiation resistant property, so it's frequently utilized as a composite insulator in an HV network for outdoor applications. The composite insulator structure is shown above in figure. 3.1. The fiber-reinforced plastic core, situated in the Centre of the insulation, and the two extremities of the insulator, which have metal fittings, are the three sub domains that make upthe structure.

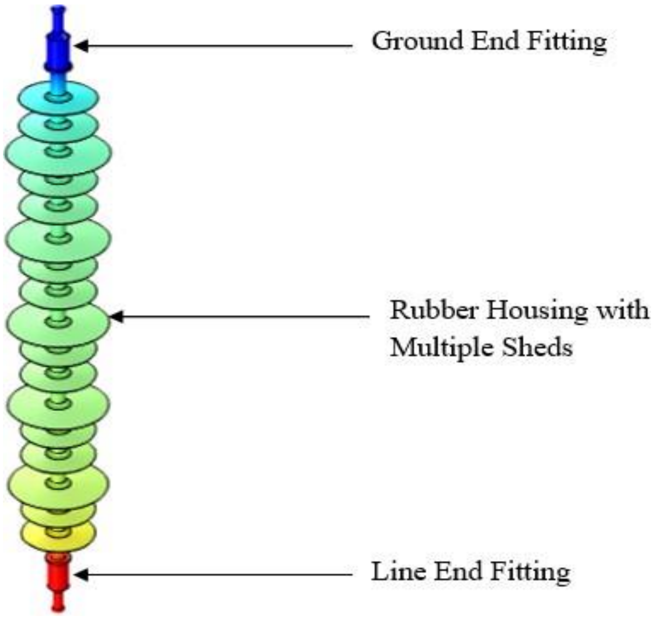


Figure 3.1 110kV Composite Insulator Structure

Comparatively, the single side and both side end fittings have the highest breakdown withstand voltage and are utilized with ball end fittings, which advantage to the insulator's two sides. Silicone rubber makes up the insulating material (forged steel). With theball end fitting utilized on both the supply and ground sides, seventeen alternative shelters arebuilt with a 110kV composite insulator.

Table 3.1 Design Parameters

Name	**Expression**	**Value**	**Description**
Vi	500[kV]	5E5 V	Overvoltage amplitude
H	30[mm]	0.03 m	The thickness of the Corona ring
D	350[mm]	0.35 m	Diameter of the Grading ring
D	150[mm]	0.15 m	Distance of the Corona rings from the end

The corona ring design parameters are shown in table 3.1. The grading ring is 350 mm in diameter, the corona ring is 30 mm thick, and the gap between the two rings is 150 mm.

From table 3.2 Creepage distance it is essential to maintain an appropriate and sufficient creepage distance to prevent tracking, which is caused by electric discharges on or around an insulation surface and results in a partly conducting path of localized degradation on the surface of insulating material.

Table 3.2 Insulator Parameters

Design parameters	**Values**
Normal Voltage	110kV
Dry lightning impulse withstand voltage	500 kV
Wet power frequency withstands voltage	230 kV
Small Shed Length	60 mm

Long Shed Length	80 mm
Shed Spacing	35.8 mm
Creepage Distance	2575 mm
Arc Over Distance	1110 mm
Core diameter	26 mm

Table 3.3 Relative Permittivity

Material	**Relative Permittivity**
Core Rod	5
Weather Shed	3
Air	1

The number of domains in the geometry model determines the material qualities ofthe model. To replicate a real-time system, conductivity and permittivity are often needed. Table 3.3 includes a list of each domain's material properties.

IV. METHODOLOGY

4.1 PROPOSED METHODOLOGY

The composite insulator design parameters data collected from various manufacturers were used in the 110kV transmission line. Finite Element software, first without corona ring design, to implement and analyze the shed surface E-field and potential distribution. If electric Stress is not uniformly distributed, place the corona ring on one or both sides first. Next, evaluate the electrical Stress; Stress is not uniformly distributed, and change the coronaring position.

Stress is reduced, stopping the changing corona ring position. Optimization is tuning the corona ring's input parameters size and changing the corona ring's distance from the insulator; the two small things significantly impact the insulator and improve the equal potential distribution. Stress is uniformly distributed; not changing the following optimization technique stops the optimization, and composite insulator life increases

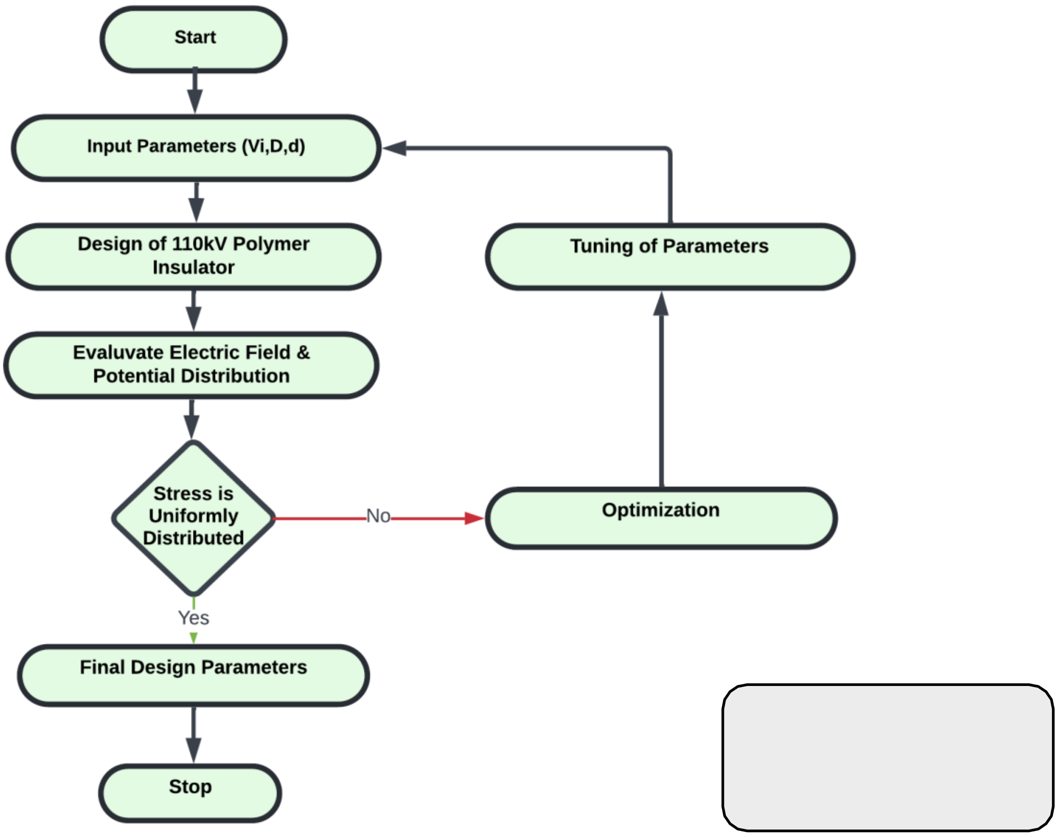


Figure 4.1 Proposed Work

V. OPTIMIZATION TECHNIQUES

5.1 OPTIMIZATION

In the more general approach, an optimization problem consists of maximizing or minimizing a real function by systematically choosing input values from within an allowedset and computing the value of the function. The generalization of optimization theory and techniques to other formulations constitutes a large area of applied mathematics. More generally, optimization includes finding "best available" values of some objective function given a defined domain (or input), including a variety of different types of objective functionsand different types of domains.

5.2 COBYLA OPTIMIZATION

Constrained optimization by linear approximation (COBYLA) is a numerical optimization method for constrained problems where the derivative of the objective function is not known, invented by Michael J. D. Powell. That is, COBYLA can find the vector $x\rightarrow\in S$ with $S\subseteq Rn$ that has the minimal (or maximal) $f(x\rightarrow)$ without knowing the gradient off. COBYLA is also the name of Powell's software implementation of thealgorithm in Fortran. COBYLA and all the other derivative-free optimization solvers of Powell's are included in PDFO, which provides MATLAB and Python interfaces for using these solvers on Linux, Mac, and Windows. Powell invented COBYLA while working for Westland Helicopters.

It works by iteratively approximating the actual constrained optimization problem with linear programming problems. During an iteration, an approximating linear programming problem is solved to obtain a candidate for the optimal solution. The candidate solution is evaluated using the original objective and constraint functions, yielding a new datapoint in the optimization space. This information is used to improve the approximating linear programming problem used for the next iteration of the algorithm. When the solution cannot be improved anymore, the step size is reduced, refining the search. When the step size becomes sufficiently small, the algorithm finishes.

5.3 NELDER OPTIMIZATION

The Nelder–Mead method is a numerical method used to find the minimum or maximum of an objective function in a multidimensional space. It is a direct search method (based on function comparison) and is often applied to nonlinear optimization problems for which derivatives may not be known. However, the Nelder–Mead technique isa heuristic search method that can converge to non-stationary points on problems that can be solved by alternative methods.

Nelder–Mead in n dimensions maintains a set of n + 1 test points arranged asa simplex. It then extrapolates the behavior of the objective function measured at each test point in order to find a new test point and to replace one of the old test points with the new one, and so the technique progresses. The simplest approach is to replace the worst point witha point reflected through the centroid of the remaining n points. If this point is better than the best current point, then we can try stretching exponentially out along this line. On the other hand, if this new point isn't much better than the previous value, then we are stepping across avalley, so we shrink the simplex towards a better point. An intuitive explanation of the algorithm. The downhill simplex method now takes a series of steps, most steps just moving the point of the simplex where the function is largest (“highest point”) through the opposite face of the simplex to a lower point. These steps are called reflections, and they are constructed to conserve the volume of the simplex (and hence maintain its non-degeneracy). When it can do so, the method expands the simplex in one or another direction to take larger steps. When it reaches a “valley floor”, the method contracts itself in the transverse direction and tries to ooze down the valley. If there is a situation where the simplex is trying to “pass through the eye of a needle”, it contracts itself in all directions, pulling itself in around its lowest (best) point.

5.4 BOBYQA OPTIMIZATION

BOBYQA is an iterative algorithm for finding a minimum of a function F(x), x∈Rn, subject to bounds a≤x≤b on the variables, F being specified by a “black box” that returns the value F(x) for any feasible x. Each iteration employs a quadratic approximation Q to F that satisfies Q(y j) = F(y j), j = 1, 2, . . . , m, the interpolation points y j being chosen and adjusted automatically, but m is a prescribed constant, the value m = 2n+1 being typical. These conditions leave much freedom in Q, taken up when the model is updated by thehighly successful technique of minimizing the Frobenius norm of the change to the second derivative matrix of Q. Thus no first derivatives of F are required explicitly. Most changes to the variables are an approximate solution to a trust region sub problem, using the current quadratic model, with a lower bound on the trust region radius that is reduced cautiously, in order to keep the interpolation points well separated until late in the calculation, which lessens damage from computer rounding errors. Some other changes to the variables are designed to improve the model without reducing F. These techniques are described. Other topics include the starting procedure that is given an initial vector of variables, the value of mand the initial trust region radius.

The method of BOBYQA is iterative, k and n being reserved for the iteration number and the number of variables, respectively. Further, we reserve m for the number of interpolation conditions that are imposed on a quadratic approximation Qk(x), x∈Rn , to F(x),x∈Rn . The approximation is available at the beginning of the k-th iteration, the interpolation equations have the form

Qk(y j) = F(y j), j =1, 2, . . . , m, (5.1)

m is a constant integer from the interval [n+2, 1 2 (n+1)(n+2)], chosen by the user of the software. We let xk be the point in the set {y j : j = 1, 2, . . . , m} that has the property

F(xk) = min{F(y j) : j =1, 2, . . . , m}, (5.2)

by giving priority to an earlier evaluation of the least function value F(xk). A positivenumber Δk, called the "trust region radius", is also available at the beginning of the k-th iteration.

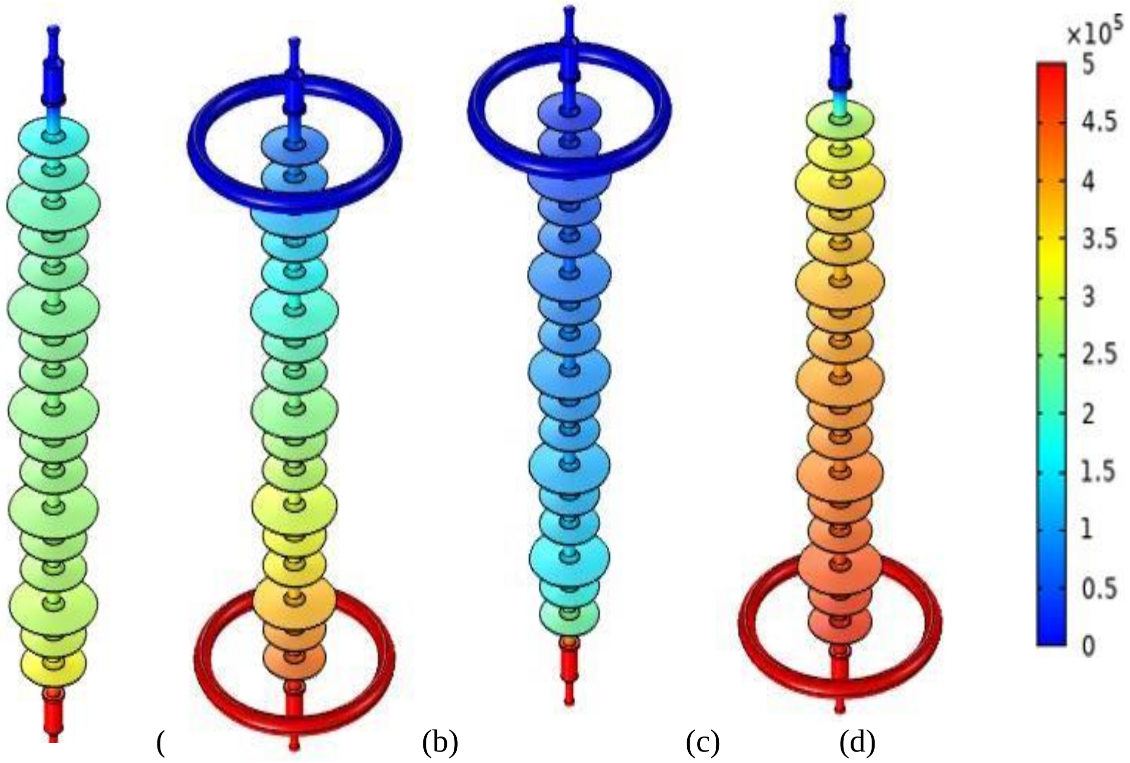
VI. RESULTS AND DISCUSSION

The basic structure of the composite insulator's electric and environmental stress reduces the lifetime of the insulator. Not possible to control the ecological stress but only the possibility of electrical stress; electrical stress is not distributed evenly, so stress increases line-side balance, and the remaining shed stress is gradually reduced. The main thing is to minimize age, making it easy to create flashovers. The Corona ring is an easy way to distribute electrical

stress equally. Three different approaches to changing the corona ring position most effectively reduce electrical stress.

6.1 ELECTRIC POTENTIAL IN HV AND LV SIDE CORONA RING

The distribution of surface electric potential without and with different side corona ring positioning. The ground side indicates zero potential, which is indicated in blue, and the line side indicates high potential, which is indicated in red.



((b) (c) (d)

Figure 6.1 Surface Electrical Potential on (a) Without Corona Ring, (b) With HV and LV side Corona Ring, (c) With LV side Corona Ring, and (d) With HV Side Corona Ring

Without the corona ring maximum, electric potential stress occurs in the nearby line conductor shed, gradually reducing the insulator life, and an easy flashover occurs. From the figure 6.1 most effectively distributed electric potential is used in corona rings, but the coronaring placed position placed a major role. Considering that different positions of corona rings shed stress, which distributes the electrical potential evenly, the HV side-positioning corona ring is better than other corona ring positions.

6.2 ELECTRIC FIELD DISTRIBUTION EXISTING INSULATOR

Figure 6.2. Indicate the E-field distribution without and with different corona ring positions. The X and Y axis indicates the Z-coordinate (mm) that is the shed surface of the insulator, and a tangential E-field (kV/cm) occurs at the shed surface of the insulator.

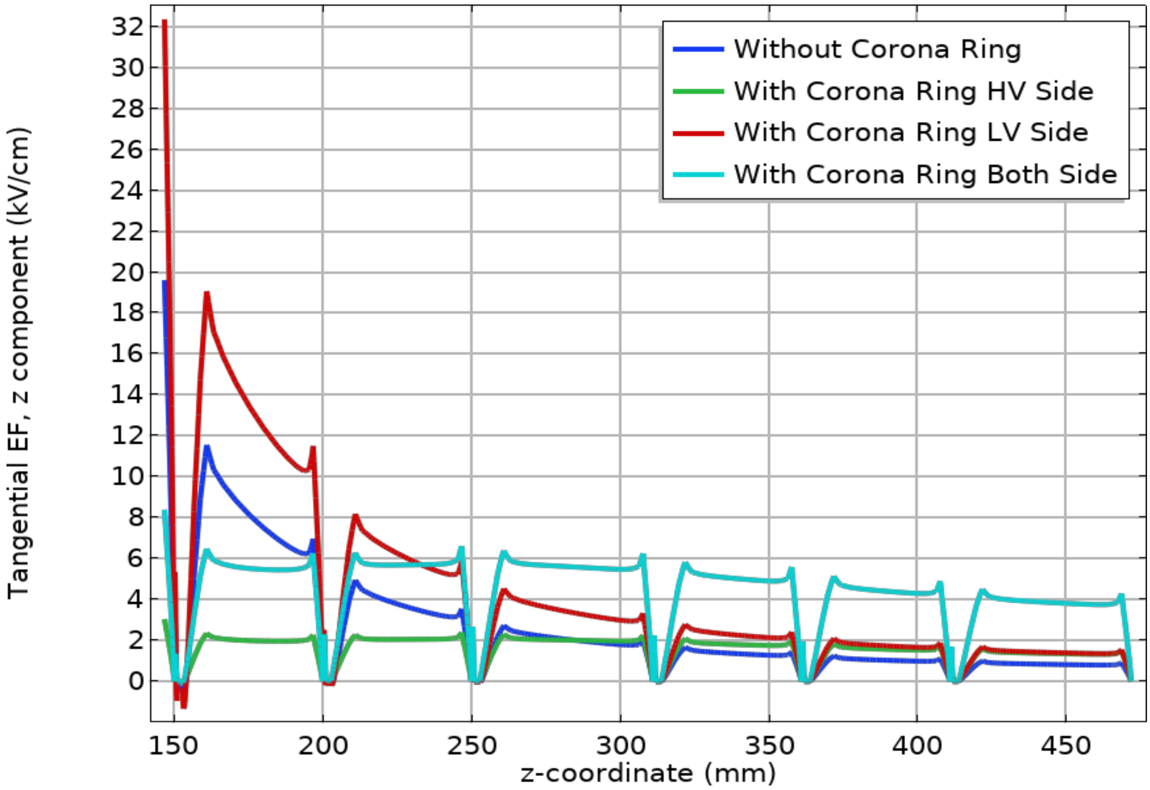


Figure 6.2 Electric Field Distribution Existing Insulator

Without a corona ring maximum, the E-field stress to create the nearest to the line conductor shed stress is 11 kV/cm. The remaining shed stress reduces gradually until the last shed stress is 1.9 kV/cm, efficiently reducing the life of the insulator. On the HV side, position the corona ring electrical field stress near the conductor shed to the final shed to maintain equal stress of 2 kV/cm, so increase lifetime.

6.3 ELECTRIC POTENTIAL DISTRIBUTION EXISTING INSULATOR

The electric potential distribution without and with various corona ring placements is shown in Figure 6.3. The X and Y axis indicates the insulator's shed surface and the electric potential. Without a corona ring, electric potential distribution is not distributed evenly, and High stress occurs on the line conductor nearest the shed. With a corona ring, HV side placement is better distributed evenly than other corona ring positions.

Table 6.1 Electric Stress of Different Corona Ring Positioning

Corona Ring Position	**Electric Field (kV/cm)**	**Electric Potential (V)*10^5**
Without Corona Ring	19	3.52
HV and LV side Corona Ring	11.5	4.46
LV side Corona Ring	6.2	2.57
HV side Corona Ring	2.03	4.72

Without a corona ring, E-field stress of up to 19 kV/cm develops close to a conductor shed. Electric potential distribution is not distributed uniformly, eventually lowering the potential distribution. Different positions with a corona ring transmit stress at a rate of 2.03kV/cm from the even conductor closest to the shed to the final shed.

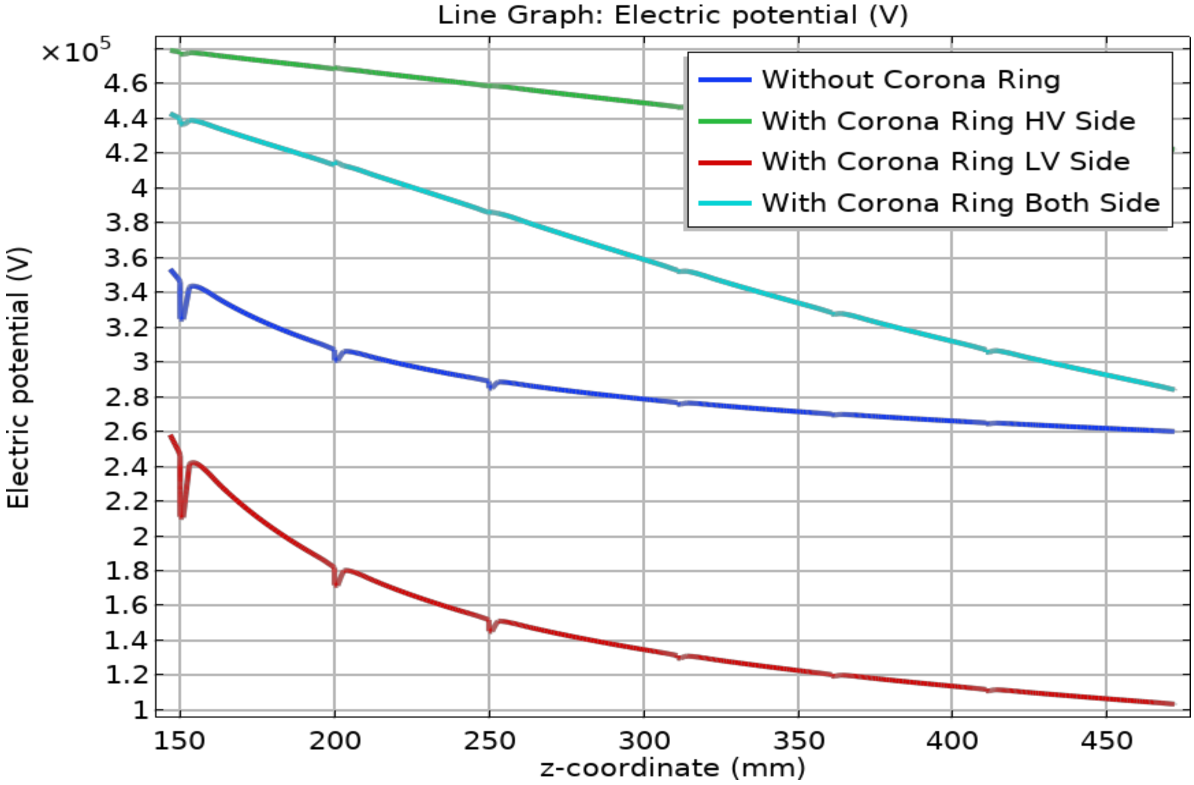


Figure 6.3 Electric Potential Distribution Existing Insulator

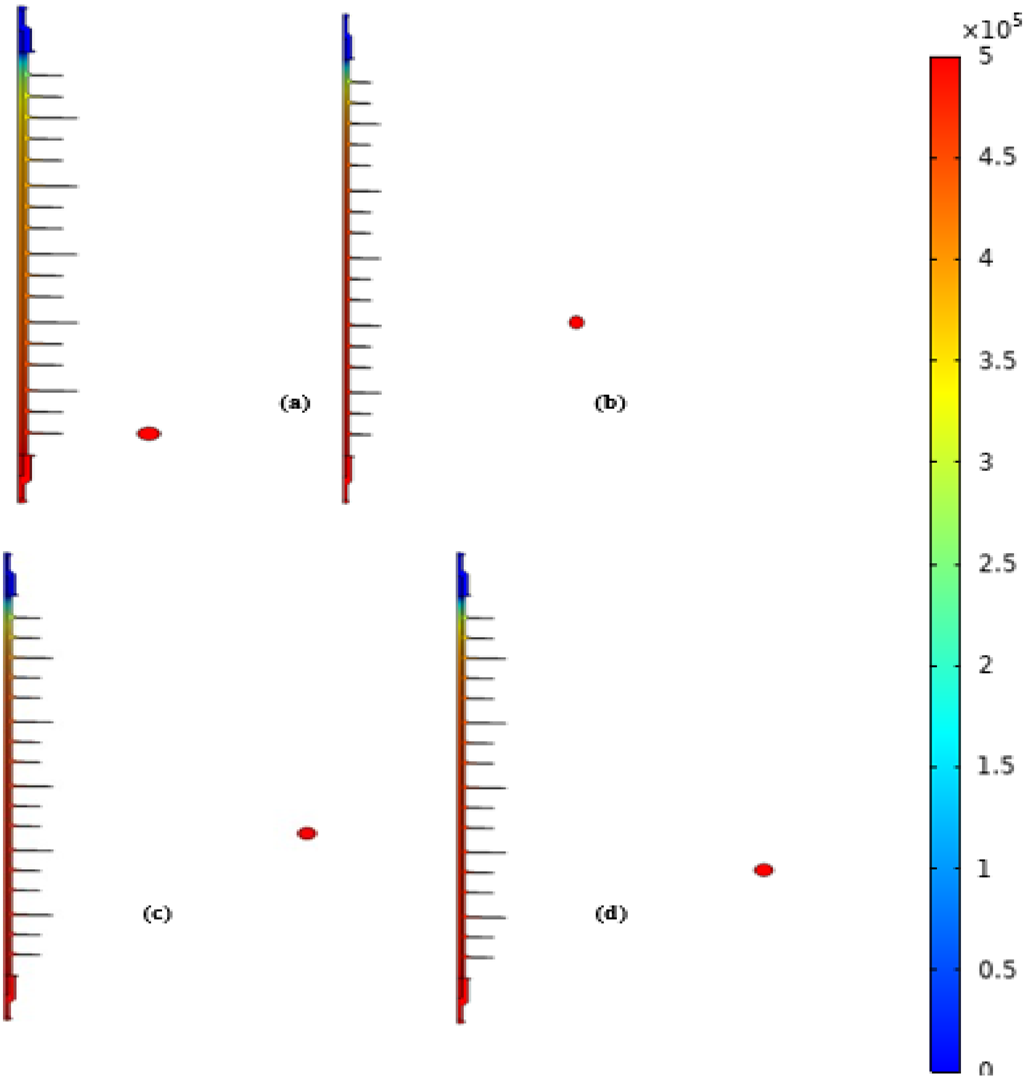


Figure 6.4 Surface Electrical Potential on 2D (a) Without Optimization Corona Ring, (b) Corona Ring Nelder Optimization, (c) Corona Ring Cobyla Optimization, and (d) Corona Ring Bobyqa Optimization

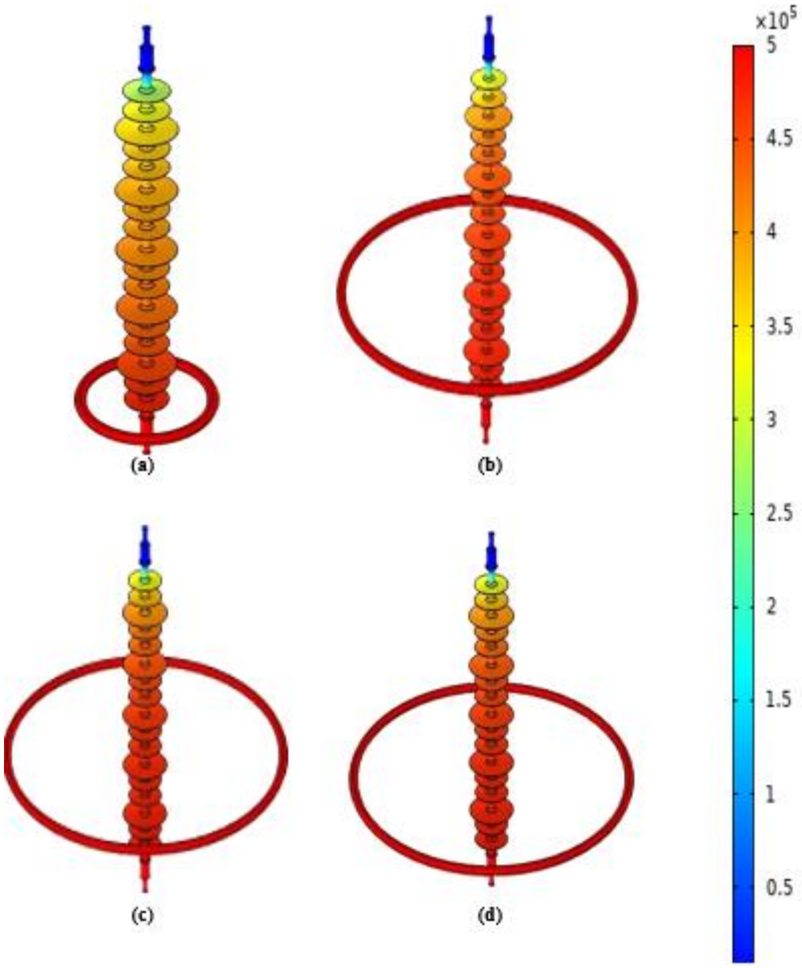


Figure 6.5 Surface Electrical Potential on 3D

(a) Without Optimization Corona Ring, Corona Ring Nelder Optimization, Corona Ring Cobyla Optimization, Corona Ring Bobyqa Optimization

Without the corona ring maximum, the neighboring line conductor shed experiences electric potential stress, reduces insulator life and leads to an easy flashover. Corona rings improve the electric potential most efficiently. Still, the location of the corona ring also plays a significant influence, so move for optimizations. Figure 6.4 and Figure 6.5 shows the HV side corona ring placement significantly reduces the electric stress. It distributes the equal potential positions and sheds stress in a way that equally distributes the electrical potential. Nelder, cobyla, and bobyqa; these three optimizations highly improve the potential distribution; optimization is to change tuning the corona ring's size and changing the corona ring's distance from the insulator; the two small things create a significant impact on the insulator improve the equal potential distribution.

6.3 ELECTRIC FIELD DISTRIBUTION IN HV SIDE CORONA RING ANDWITHOUT CORONA RING

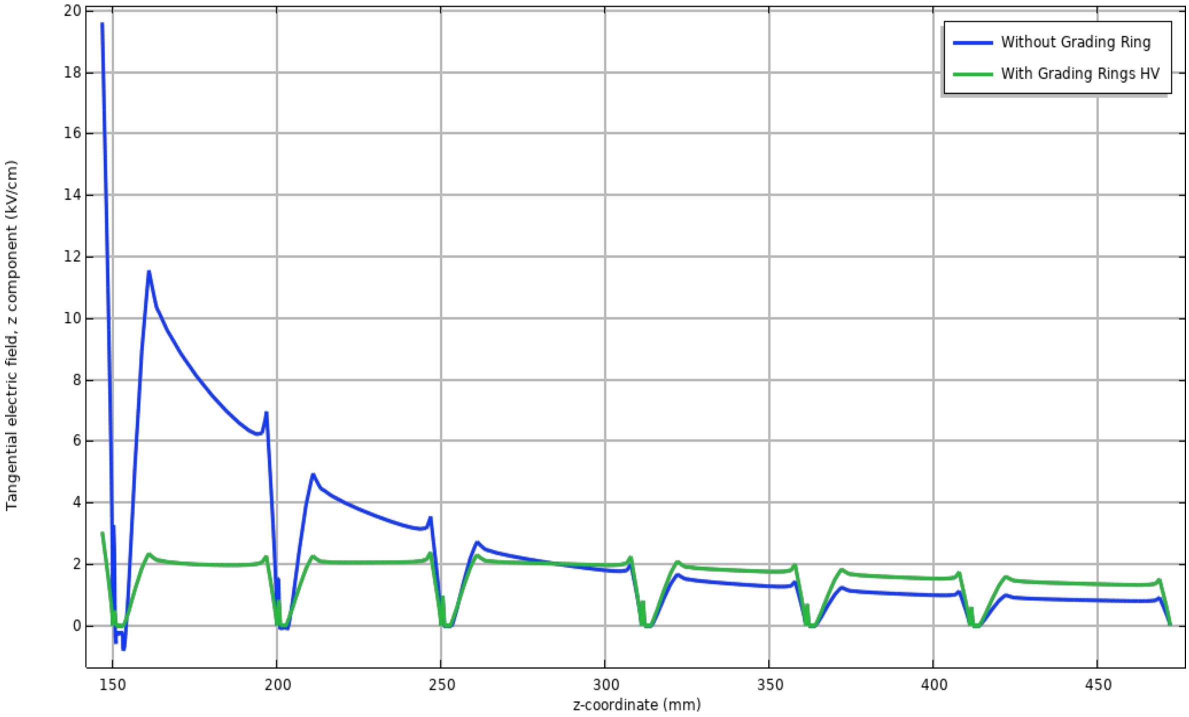


Figure 6.6 Electric Field Distribution in HV Side Corona Ring and Without Corona Ring

The E-field stress required to generate the stress closest to the line conductor shed, without a corona ring maximum, is 11.7 kV/cm. Figure 6.6 shows the life of the insulator is effectively decreased when the residual shed stress continuously decreases until the final shedstress is 1.9 kV/cm. Place the corona ring electrical field stress close to the conductor shed to the last shed on the HV side to maintain an equivalent stress of 2.1kV/cm and improve the lifetime insulator.

6.4 ELECTRIC FIELD DISTRIBUTION IN DIFFERENT OPTIMIZATIONS

Figure 6.7 shows the HV side corona ring placement, the E-field stress to create the nearest to the line conductor shed stress is 2.1 kV/cm. The remaining shed stress reduces gradually until the last shed. Potential distribution is only partially uniformly efficiently reducing the life of the insulator. On the HV side, corona ring optimization is electrical field stress near the conductor shed to the final shed to maintain equal stress of 1.1 kV/cm, almost achieving uniform distribution to improve the lifetime insulator. From the figure 6.8 at the portion of 270mm to 300mm, z coordination shows the details difference in three optimization results cobyla is the least get electric filed value and highly reduced best achievelow electric field is bobyqa.

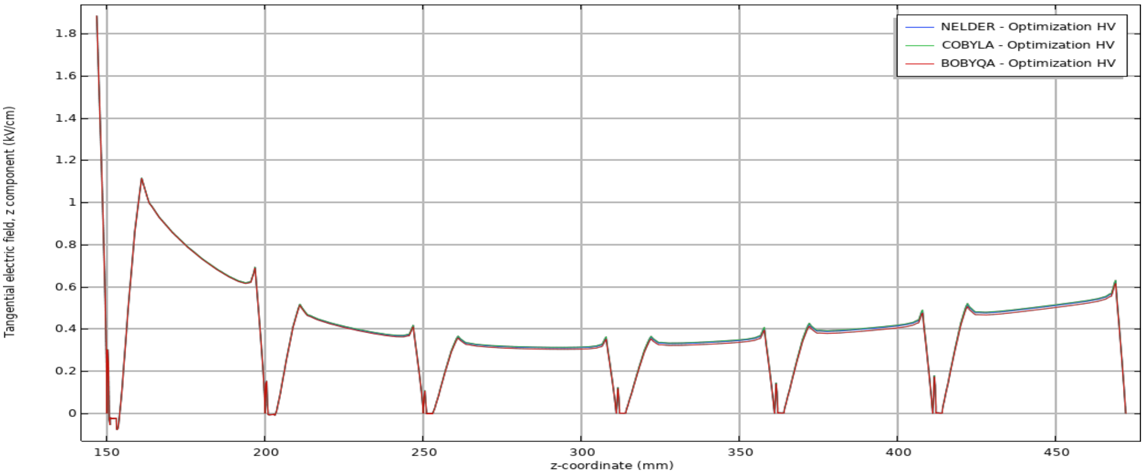


Figure 6.7 Electric Field Distribution in Different Optimizations

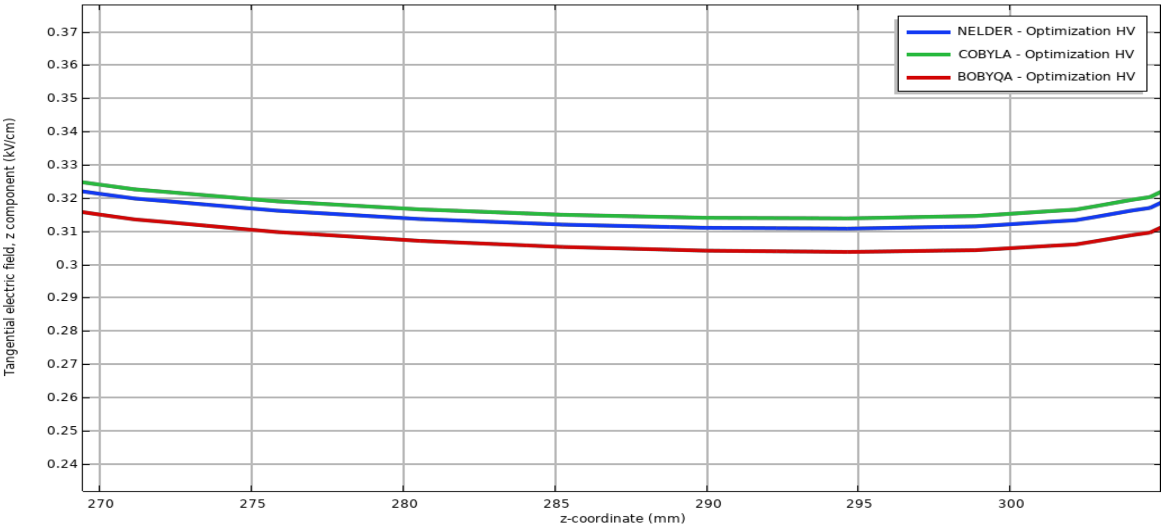


Figure 6.8 Electric Field Distribution in Different Optimizations at the Portion

6.5 ELECTRIC POTENTIAL DISTRIBUTION IN HV SIDE CORONA RINGAND WITHOUT CORONA RING

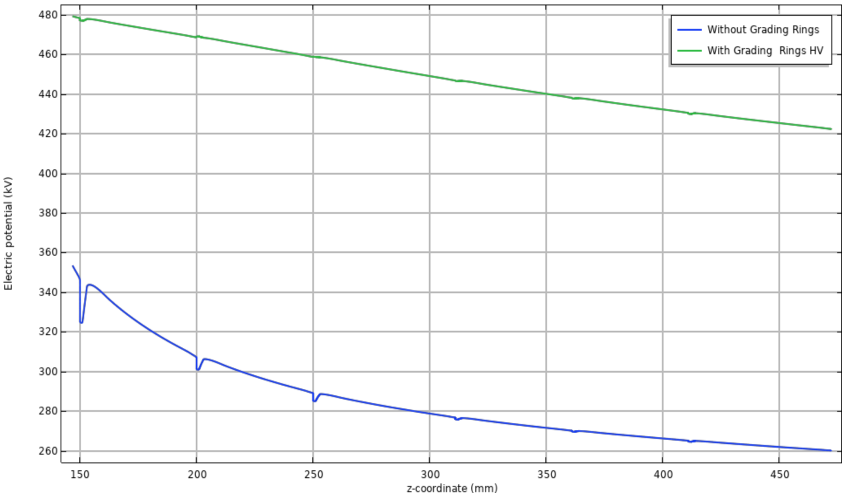


Figure 6.9 Electric Potential Distribution in HV Side Corona Ring and Without CoronaRing

The electric potential distribution without and with HV side corona ring placements isshown in Figure 6.9 The X and Y axis indicates the insulator's shed surface and the electric potential. Without a corona ring, electric potential distribution is not distributed evenly; high stress occurs on the conductor nearby shed and gradually reduces the potential distribution. With the HV side corona ring, HV side placement is almost better distributed evenly to all sheds.

6.6 ELECTRIC POTENTIAL DISTRIBUTION IN DIFFERENT OPTIMIZATIONS

Figure 6.10 shows the HV side corona ring placement, the potential distribution is not evenly conductor nearby shed high potential stress occurs and at ground end fitting side reduce the potential distribution not distributed evenly. Potential distribution is only partially uniformly efficiently reducing the life of the insulator. On the HV side, corona ring optimization is potential stress near the conductor shed to the final shed to maintain equal stress, almost achieving uniform distribution to improve the lifetime insulator. From the figure 6.11 at the portion of 267 mm to 275 mm, z coordination shows the details difference in three optimization results cobyla is the least potential distribution value and highly evenly distributed potential is bobyqa.

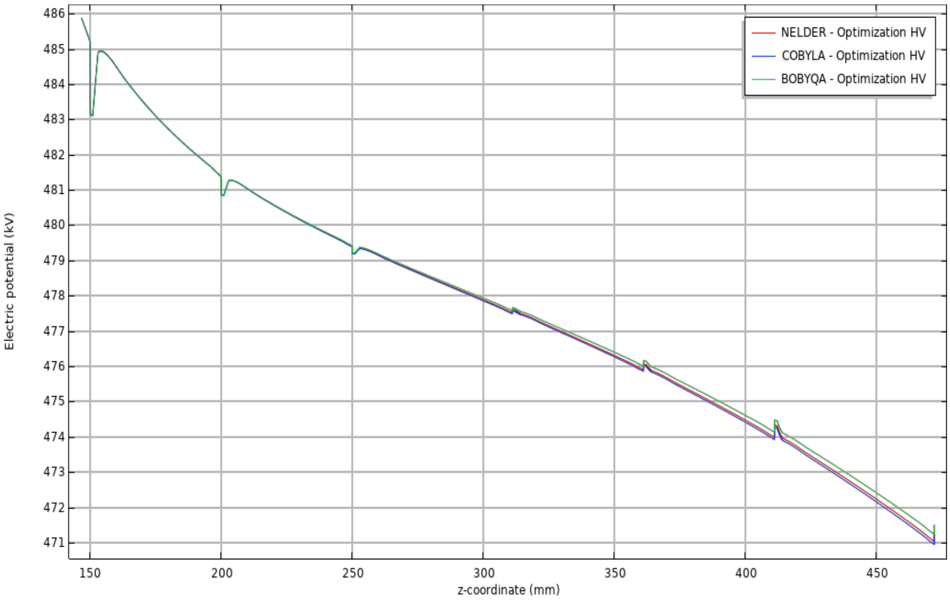


Figure 6.10 Electric Potential Distribution in Different Optimizations

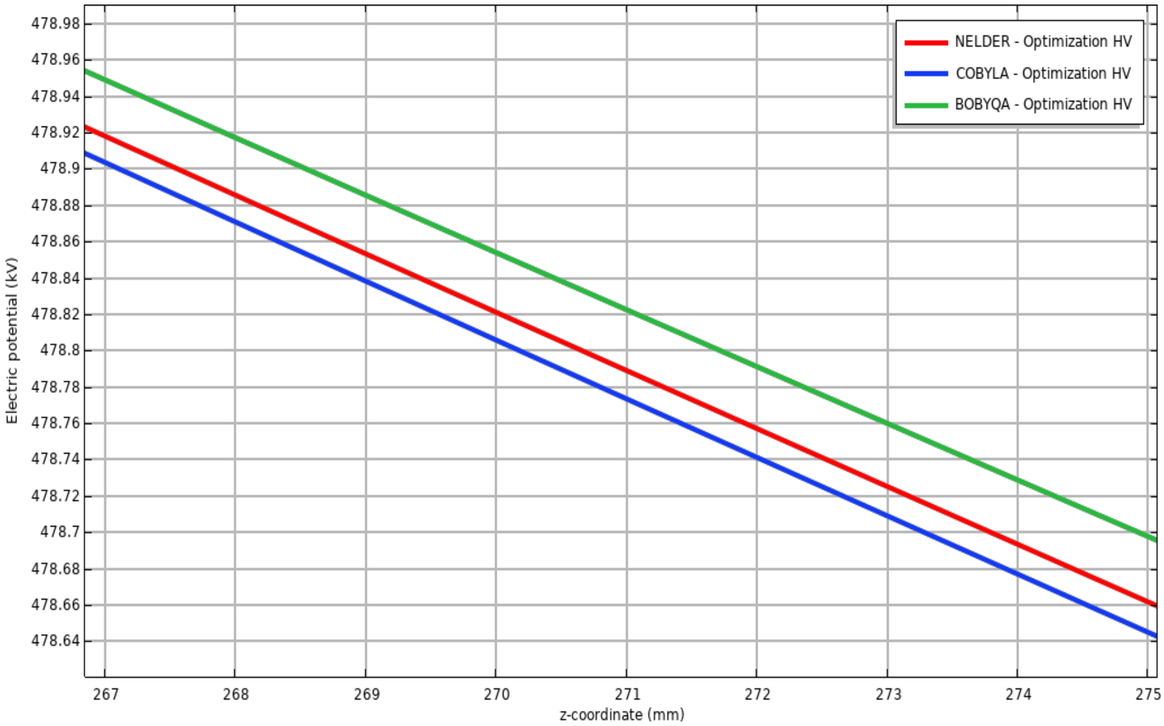


Figure 6.11 Electric Potential Distribution in Different Optimizations at the Portion

Table 6.2 Optimized Corona Ring Parameters

Optimization	**Nelder**	**Cobyla**	**Bobyqa**
Ball end fitting	D=1	D=1	D=1
	d=0.41992	d=0.45493	d=0.43124
Clevis end fitting	D=1	D=1	D=0.99839
	d=0.42444	d=0.42445	d=0.42181
Oval end fitting	D=1	D=1	D=1
	d=0.42895	d=0.41643	d=0.423
Socket end fitting	D=1	D=1	D=1
	d=0.42587	d=0.42172	d=0.42013
Tongue end fitting	D=1	D=1	D=0.61099
	d=0.49201	d=0.5	d=0.32058
Y-Clevis end fitting	D=1	D=1	D=1
	d=0.41992	d=0.42514	d=0.39684

Table 6.2 shows that Three consecutive optimization techniques are applied to the Sixdifferent end fittings. D is the diameter of the Corona Ring, and d is the distance of thecorona ring. Optimization techniques are tuning the parameters within limits to reach the almost objective value. bobyqa optimization has almost reached the objective, majorly modifying the parameters; Nelder and cobyla tuning parameters values are minimum, so it's taken as the last two places.

Table 6.3 shows that D is the diameter of the Corona Ring, and d is the distance of thecorona ring. Optimization techniques are tuning the parameters within limits to reach the almost objective value. The distance of the corona ring almost matches all the different end fittings; the diameter of the Corona Ring differs from all the different end fittings. The maximum reach objective is Y-clevis end fitting least reach objective is on the ball end fittinginsulator.

Table 6.3 Objective Parameters

Parameters	D (mm)	d (mm)	Objective (mm)
Ball end fitting	0.40	0.21	2.41E5
	0.60	0.21	2.32E5
Clevis end fitting	0.40	0.21	2.74E5
	0.60	0.21	2.67E5
Oval end fitting	0.40	0.21	2.74E5
	0.60	0.21	2.67E5
Socket end fitting	0.40	0.21	2.80E5
	0.60	0.21	2.73E5
Tongue end fitting	0.40	0.21	1.84E5
	0.60	0.21	1.38E5
Y-Clevis end fitting	0.40	0.21	2.77E5
	0.60	0.21	2.69E5

VII. CONCLUSION

The uniform distribution of E-field and electric potential, analyze and reduce the threedifferent types of corona ring positioning. Finding the best way to reduce electric stress corona ring positioning is possible. The electric stress computation identifies the high electricstress that occurs nearest the conductor shed; this electrical stress creates major problems for most real-time applications. Without a corona ring, E-field stress of up to 11.5 kV/cmdevelops close to a conductor shed, and electric potential distribution is not distributeduniformly. Different positions with a corona ring transmit stress at a rate of 2.03kV/cm from the even conductor closest to the shed to the final shed. After optimization, 4.85*10^5 kV/cm electric potential stress is distributed rate increase, and 1.1 kV/cm electric stress is reduced bydouble the time of HV side placed corona ring and uniformly distributed electric potential. Furthermore, to enhance the composite insulator's electrical behavior and long-term performance, fatherly implements the optimization of the corona ring size and shed size; the insulator highly reduces the E-field strength and electrical stress close to the end fitting.

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