CIGRE Study Committee B2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG [1] B2.80	**Name of Convenor:** LEHRETZ, Fabian (Germany)	
Strategic Directions #[2]: 1,2		**Sustainable Development Goal #[3]: 9**
The WG applies to distribution networks: ☒ Yes / ☐ No		
Potential Benefit of WG work #[4] : 1, 2, 3,4,6		
Title of the Group: Numerical Simulation of electrical fields on AC and DC Overhead Line Insulator Strings		

Scope, deliverables and proposed time schedule of the WG:

Background:

Besides other applications, the finite element method (FEM) and the boundary element method (BEM) are the most widely used numerical simulation methods for the assessment and evaluation of the electrical fields on insulator strings. Within the last years, the availability of simulation results for insulator strings increased significantly. Based on service experience and laboratory testing it is known that a high local electric field can lead to increased corona activity and ageing of insulators. Especially silicone coatings on ceramic or glass insulators or composite insulators can suffer from a high local electrical field and recommended criteria to limit the electric field have been published by both, the Electric Power Research Institute (EPRI) and the Swedish Transmission Research Institute (STRI). So, a low and homogenous electric field distribution along the insulator string is beneficial for the longevity of the insulator string.

However, the large number of available software solutions and vendors lead to different solutions and determined numerical results. Additionally to this, there isn´t a standard procedure available how the model of the insulator string has to be designed and how hardware, such as corona rings, conductor configurations, tower dimensions and important areas of the insulator like the interface design between housing material and the metal end fitting (triple point) have to be evaluated. The surroundings are normally defined within a laboratory test and a minimum should also be defined as standard for simulations. Since no standard procedure is available, it is up to each transmission and distribution system operator (TSO and DSO) to make sure their requirements are sufficiently tough.

The proposed working group will focus on especially these aspects in order to make FEM/BEM simulation electric field calculations more reliable and comparable.

Scope:

1. Literature research on the topic of numerical simulations of overhead line insulator strings.
2. Determination of insulator string configurations which will be used for the subsequent round robin test. Definition, how the standard insulator string must be defined to ensure reliable simulation results.
3. Determination of the standard setup (tower and conductor configurations, other hardware components) which should be used for the subsequent round robin test.
4. Determination of the standard procedure to evaluate the results.

5. Simulation of the defined models including parameters by several participants of the working group (round robin test) by using various software packages and simulation methods (FEM/BEM).
6. Adaption of the simulation parameters according to the gained knowledge and repetition of the simulation.
7. Assessment of simulation results and definition of standard procedure.
8. Compilation of results and creation of Technical Brochure.

Needs:

This working group is required by transmission and distribution system operators in order to compare the reliability of electrical field calculations on different insulator string configurations from different manufacturers.

Producers of insulators and hardware components can use the established procedures to compare and improve their designs.

The findings of this working group can be used in international standard committees for the definition of standardized simulation methods.

Reference to other Technical Brochures and WGs relevant for this WG

- CIGRE Technical Brochure 284, Use of corona rings to control the electric fields along transmission line composite insulator
- CIGRE Technical Brochure 794, Field grading in electrical insulation systems

Deliverables:

☒ Technical Brochure and Executive Summary in Electra
☐ Electra Report
☐ Future Connections
☐ CSE
☒ Tutorial
☒ Webinar

Time Schedule: start: August 2020 **Final Report**: August 2023

Approval by Technical Council Chairman:

Date: April 9th, 2020

Notes: [1] Working Group (WG) or Joint WG (JWG), [2] See attached Table 1, [3]See attached Table 2 and CIGRE reference Paper: Sustainability – at the heart of CIGRE's work. [4] See attached Table 3

Table 1: Strategic directions of the Technical Council

1	The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-of-the-art technological advances
2	Making the best use of the existing systems
3	Focus on the environment and sustainability (in case the WG shows a direct contribution to at least one SDG)
4	Preparation of material readable for non-technical audience

Table 2: Environmental requirements and sustainable development goals

	CIGRE selected the 7 SDGs that are the most relevant to CIGRE. In case the WG work refers to other SDGs or do not address any specific SDG, it will be quoted 0.
0	Other SDGs or not applied
7	**SDG 7: Affordable and clean energy** Increase share of renewable energy; e.g. expand infrastructure for supplying sustainable energy services; ensure universal access to affordable, reliable, and modern energy services; energy efficiency; facilitate access to clean energy research and technology
9	**SDG 9: Industry, innovation and infrastructure** Facilitate sustainable infrastructure development; facilitate technological and technical support
11	**SDG 11: Sustainable cities and communities** Increase attention on sustainable and resilient buildings utilizing local (raw) materials, power for electric vehicles, strengthening long-line transmission and distribution systems to import necessary power to cities, developing micro-grids to reinforce the sustainable nature of cities; protect and safeguard the world's cultural and natural heritage; reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and waste management
12	**SDG 12: Responsible consumption and production** E.g. Promote public procurement practices that are sustainable; address reducing use of SF6 and promote alternatives, encourage companies to adopt sustainable practices and to integrate sustainability information into their reporting cycle, address inefficient fossil-fuel subsidies that encourage wasteful consumption
13	**SDG 13: Climate action** E.g. Increase share of renewable or other CO_2-free energy; energy efficiency; expand infrastructure for supplying sustainable energy; strengthen resilience and adaptive capacity to climate-related hazards and natural disasters; integrate climate change measures into national policies, strategies and planning; improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
14	**SDG 14: Life below water** E.g. Effects of offshore windfarms; effects of submarine cables on sea-life
15	**SDG 15: Life on land** E.g. Attention for vegetation management; bird collisions; integration of substations and lines into the landscape

Table 3: Potential benefit of work

1	Commercial, business, social and economic benefits for industry or the community can be identified as a direct result of this work
2	Existing or future high interest in the work from a wide range of stakeholders
3	Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry
4	State-of-the-art or innovative solutions or new technical directions
5	Guide or survey related to existing techniques; or an update on past work or previous Technical Brochures
6	Work likely to contribute to improved safety.