Optimization of a 320 kV Cable Joint Specimen During Steady State Operation

TECHNISCHE UNIVERSITÄT DARMSTADT

Proposal for a Bachelor's thesis | Master's thesis | HiWi job
Study field: Electrical Engineering | Computational Engineering

Description

In the context of the green energy transition, efficient long-distance power transmission becomes increasingly important. The losses of extruded high voltage direct current (HVDC) systems are lower than those of high voltage alternating current systems and, hence, more and more HVDC systems are being deployed.
Cable joints connect cable segments, which are limited in length due to transport limitations (see Fig. 1a). Cable joints are known to be the weakest part of HVDC systems as they are exposed to high internal field stresses. These stresses can be reduced by inserting a layer of so called field grading material (FGM), that features a strongly nonlinear conductivity (see Fig. 1b). The FGM balances the electric field stress by becoming highly conductive in areas with high field strengths and, thus, shifting the voltage drop to less stressed areas. The aim of this work is to optimize the nonlinear conductivity of a 320 kV HVDC cable joint specimen during steady state operation.

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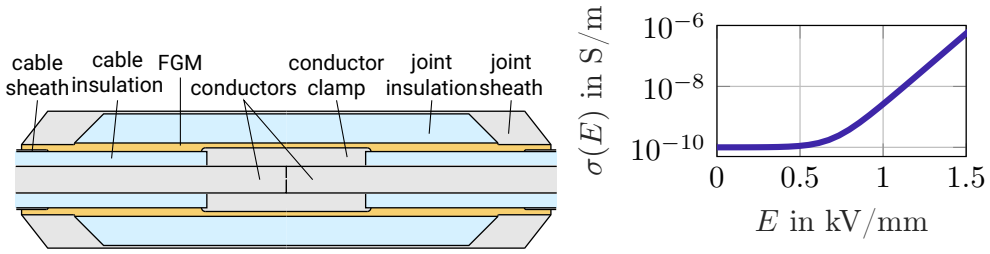
Work plan

- Getting acquainted with the most important quantities of interest for cable joints.
- Identification of the most influential parameters through sensitivity analysis.
- Definition of an objective function.
- Gradient-based optimization of the objective function with respect to (a subset of) the parameters.

Prerequisites

Joy in programming, interest in numerical methods and field simulation, basic knowledge in electrodynamics. No prior knowledge about cable joints is required.



(a) (b)

Figure 1: (a) 320 kV HVDC cable joint specimen. (b) Nonlinear field-dependent electric conductivity of FGM.