Simulation of an Impulse Arc Discharge in Line Lightning Protection Devices

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Abstract

Line lightning protection devices (LLPD) nowadays are widely used for lightning protection of overhead power lines. LLPD is composed of electrodes in series embedded in silicone rubber which all together forms sequence of spark gaps. When lightning overvoltage is applied it causes electrical breakdown in every spark gap. From this point spark gap starts to operate as discharge chamber, lightning current flows through LLPD. Strong pressure rise and Lorentz forces result in intensive outflow which eventually leads to arc quenching. Numerous experiments proved that arc quenching efficiency strongly depends on LLPD geometry. Since experimental search for design improvement is expensive and time-consuming numerical simulations are considered as alternatives for design optimization. The arcing process triggered by lightning strike implies short time scales together with high temperatures and pressures so complex physics should be taken into account. In order to decrease the complexity of the problem simplified CFD approach was applied for first step with the help of high mach flow number in the CFD Module of COMSOL Multiphysics®. To assess performance of certain chamber design the value of residual electric conductivity is chosen as a parameter of evaluation. Preliminary results of simulations are introduced and discussed.

Figures used in the abstract

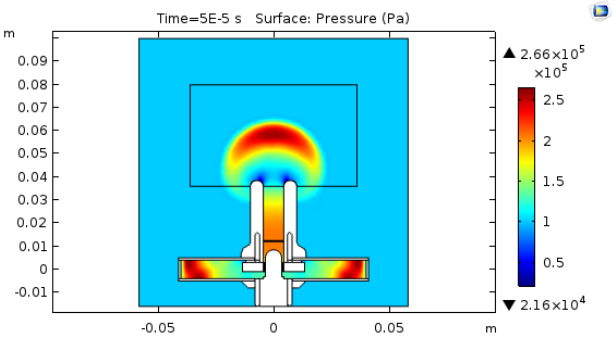

Figure 1: An impulse arc discharge.