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Very Fast Overvoltage Computation in GIL due to switching operations with disconnectors in GIS

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The purpose of this article is to investigate the Very Fast Front overvoltages, which occur on the 110 kV Gas Insulated Transmission Lines (GIL line insulated with SF_6/N_2 gas mixture), due to switching a disconnector in GIS.

Electrical stresses occur during the switching operation with disconnectors in a GIS to which GIL is connected and they are determined via simulation. The modeling of GIL (directly buried with polymer sheath enclosure), allowed for a series of observations with regard to the parameters of the generated VFTO.

The empirical distribution functions of the VFTO were calculated in [p.u.], depending on polarity, as well as the U_p^* - overvoltage amplitude profile along the GIL, caused by a switching operation with disconnectors in GIS, and on the 123 kV GIL line connected to the station (at both ends and at the middle of the GIL). In the corresponding configurations the switching operation were correlated to the annual probabilities and 500 transients were simulated.

To establish the empirical cumulative distribution function, the following random independent variables were considered: bus bars voltage value, the trapped charge left on a part of GIS after switching operations, the power of the supply, as well as the station configuration.

The statistical parameters of the VFTO in GIS and on GIL were approximated through theoretical functions: Weibull, normal, lognormal, gamma, beta. The optimal approximation was chosen based on the Kolmogorov-Smirnov statistical test for the significance level $\alpha = 0,01$.