

## LIGHTNING-INDUCED VOLTAGES ON OVERHEAD LINES-APPLICATION OF THE EXTENDED RUSCK MODEL

Alexandre Piantini, Senior Member, IEEE, and Jorge M. Janiszewski

(Invited Paper)

**Abstract:** Lightning-induced overvoltages have a considerable impact on the power quality of overhead distribution and telecommunications systems, and various models have been developed for the computation of the electromagnetic transients caused by indirect strokes. The most adequate has been shown to be the one proposed by Agrawal *et al.*; the Rusck model can be visualized as a particular case, as both models are equivalent when the lightning channel is perpendicular to the ground plane. In this paper, an extension of the Rusck model that enables the calculation of lightning-induced transients considering flashes to nearby elevated structures and realistic line configurations is tested against data obtained from both natural lightning and scale model experiments. The latter, performed under controlled conditions, can be used also to verify the validity of other coupling models and relevant codes. The so-called Extended Rusck Model, which is shown to be sufficiently accurate, is applied to the analysis of lightning-induced voltages on lines with a shield wire and/or surge arresters. The investigation conducted indicates that the ratio between the peak values of the voltages induced by typical first and subsequent strokes can be either greater or smaller than the unity, depending on the line configuration.

**Index Terms:** Electromagnetic induction, lightning, lightning-induced voltages, overvoltage protection, power distribution lines.