

Sessions 3a, 3b, 3p: Moderator's Report

LEMP and lightning induced effects

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Introduction

A total of 15 papers have been accepted for session 3 "LEMP and lightning induced effects":

- 7 papers for oral session 3a
- 6 papers for oral session 3b
- 2 papers for poster session

The first oral session is about tall structures and systems of the power supply. The topic of the second oral session is assigned to common structures.

Oral Session 3a: Tall structures and systems of the power supply

On the calculation of electromagnetic fields radiated by lightning to tall structures

D.Pavanello, F.Rachidi, M.Rubinstein, J.L.Bermudez, C.A.Nucci ; Switzerland, Italy

Existing return stroke models are extended to take into account the presence of elevated strike objects. The authors suggest to add a so-called "turn-on" term in the field equations determined by the current discontinuity at the return stroke wave front.

Lightning coupling to overhead and buried conductors as frequency response function of the system

J.Bajorek, M.Gamracki, G.Maslowski ; Poland

The errors resulting from discrete time-domain and frequency-domain analysis are investigated. With different methods, the lightning induced voltage is calculated assuming a 1000 m long transmission line located 10 m above ground.

Experimental analysis of lightning-induced currents in buried cables

E.Petrache, M.Paolone, F.Rachidi, C.A.Nucci, V.Rakov, M. Uman, D.Jordan, K.Rambo, J.Jerauld, M.Nyffeler, B.Reusser, A.Cordier, T.Verhaege ; Switzerland, Italy, U.S.A., France

The experimental results are obtained at the International Center for Lightning Research & Testing (ICLRT), Camp Blanding, Florida (USA). Currents induced by triggered and natural lightning were measured at the ends of buried cables, both in the shield and in the inner conductor. Further, the horizontal magnetic field and the currents of triggered lightning were measured.

Testing of the LIOV-EMTP96 code for computing lightning-induced currents on real distribution lines: Triggered-lightning experiments

M.Paolone, J.Schoene, M.Uman, V.Rakov, D.Jordan, K.Rambo, J.Jerauld, C.A.Nucci, A.Borghetti, F.Rachidi, E.Petrache; Italy, U.S.A., Switzerland

The experimental data obtained at the ICLRT are used to validate the LIOV-EMTP96 computer code. At a overhead line several quantities were measured as the currents on the phases and through the installed surge arresters. As a major result, the calculated results are in a good agreement to the experimental data.

Lightning effects on the vicinity of elevated structures

F.H.Silveira, S.Visacro, A.R.De Conti ; Brazil

A lightning strike to a 50 m high telecommunication mast is simulated. In the vicinity of the mast, a radio base station and a power line are located. The used computer program was developed by the research group and bases on the so-called Hybrid Electromagnetic Model. Different quantities are investigated, especially the over-voltages induced in the power line.

A system for simultaneous measurements of lightning induced voltages on lines with and without arresters

A.Piantini, T.O.de Carvalho, A.S.Neto, J.M.Janiszewski, R.A.C. Altafim, A.L.T.Nogueira ; Brasil

The lightning induced voltage is measured at two single phase experimental power lines located at the campus of the University of Sao Paulo, Brasil. The 2.7 km long, non energized power lines are installed in parallel on the same masts. The induced voltages are measured at two different locations on each line. Surge arresters are installed at one of the lines, while the other one is not protected for comparison.

Penetration of lightning induced transient from high voltage to low voltage power system across distribution transformers

R.Montano, V.Cooray ; Sweden

A power system is simulated with the EMTP-computer program. A modification of the Agrawal's model is used to take into account the induction effects of the lightning electromagnetic field. The over-voltages are analysed penetrating from the high voltage power system through the transformer to the low voltage power system. Moreover, the effects of surge protective devices installed at the transformer are considered.

Oral Session 3b: Common structures

Magnetic fields and induced voltages in case of a direct strike—comparison of results obtained from measurements at a scaled building to those of IEC 62305-4

A.Kern, F.Heidler, M.Seevers, W.Zischank ; Germany

For the application of the concept of Lightning Protection Zones (LPZ), the knowledge of the fields and the induced voltages inside a structure is necessary. Because of the limited size of high voltage laboratory, down-scaled models with reduced dimensions are used. Such models require, that the electrical quantities are scaled adequately. In the presented paper the relations between the electrical quantities of real-size structures and the down-scaled model are given. These relations are used to compare the calculations based on the formulae given in the standard IEC 62304-4 to measurements at a down-scaled model.

Magnetic fields and induced voltages inside LPZ 1 measured at a 1:6 scale model building

W.Zischank, F.Heidler, J.Wiesinger, K.Stimper, A.Kern. M.Seevers ; Germany

Laboratory experiments were conducted at a down-scaled model of a building (scale factor 1:6) in case of direct lightning strike. The down-scaled model represents a small industrial building with two layers of reinforcement. Inside the scaled model, the magnetic field and magnetic field derivatives were measured at several locations and the voltages induced in cable routes were determined.

Electromagnetic field coupling to non-symmetrical transmission line inside an LPS

F.Zago, G.P.Caixeta, J.Pissolato Filho, J.Rossi ; Brazil

A computer program is introduced based on a transmission line model (TLM). For nearby and direct lightning, the voltages induced in a line can be calculated even for the case that the line is installed inside a building.

Experiments with voltages induced in installation circuits by discharges simulating those of lightning

M.Loboda, S.Slusarek, M.Kuzminski, Z.Flisowski; Poland

A loop was installed in a grid-like cubic metal structure (side length 2 m) using different number of conductors at the wall. The voltage induced in the loop was investigated for various configurations and for nearby and direct strike.

The lightning shielding effect of buildings: A reduced model study

T.F. Milagres, G.C.Miranda, J.O.S.Paulino, C.F.Barbosa; Brazil

A down-scaled model with a scaling factor 1:50 was used to study the lightning shielding effects of buildings in case of nearby lightning. The shielding factors were determined for the electric and the magnetic field.

Electromagnetic field radiation due to lightning strokes in the presence of tall buildings: Modeling and measurement

B.Naghikhani, R.Moini, S.H.H.Sadeghi ; Iran

The effects of a 40 m high seven-storey building was analysed on the electromagnetic field received with two sensors of a lightning detection system. The sensors are located at the roof and the 5th floor. The experimental data are compared to the results of a computer program based on the Method of Moments.

Poster session

Induced voltages in AC overhead power lines and shared-corridor pipelines during normal operation and lightning strikes

I.A. Metwally, F. Heidler; Germany

The paper presents a case study of a pipeline running in parallel to overhead power lines. A 1 km long, 132-kV, 3 phase, double circuit overhead line and a 2 km long pipeline, 1 m above ground are simulated with a computer program based on the Method of Moments. For different arrangements the voltage is investigated induced into the pipeline and the phases of the overhead line.

High loss horizontal transmission line investigation

R. K. Moreira, J.O.S.Paulino, A.A.de Araujo; Brasil

Laboratory experiments and computer simulations are presented for a high loss horizontal transmission line. The authors suggest to apply this configuration also to the case of a vertical lightning channel.