Plan Overview

A Data Management Plan created using DMPTool

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Title: Modelling conventional and tall transmission towers directly in time domain for electromagnetic transient analysis

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Project abstract:

This project is a continuation of the doctorate (FAPESP grant 2014/18551), in which a methodology was developed to model transmission towers directly in the time domain taking into account the tower-footing grounding system, real soils, and tower structure. Such parameters are generally omitted in traditional transmission tower modeling. Additionally, tall towers were studied in which no proper model was proposed in the scientific literature. It was found that the models for traditional transmission towers are not suitable for the representation of tall towers. Based on these models, the frequency-response (admittance) of several conventional and tall transmission towers will be computed using the Method of Moments (MoM), considering the grounding system. Frequency-dependent soil electrical parameters, stratified soils, and new grounding topologies and transmission towers will be considered in this project, complementing the results of the doctorate. This admittance is approximated by a rational function and then a lumped electric circuit is synthesized and it can be incorporated in any EMTP-type software for simulating electromagnetic transients directly in the time domain. Thus, the development of a new model offers a precise computation of the overvoltages resulting from lightning strikes at the transmission towers. Furthermore, a reduction in the failure of the insulators, and consequently a reduction in the number of outages from the transmission system due to the occurrence of backflashover can be obtained.

Start date: 05-01-2019

End date: 04-30-2021

Last modified: 01-18-2024

Copyright information:

Modelling conventional and tall transmission towers directly in time domain for electromagnetic transient analysis

Data created are divided into three parts:

First, the data are obtained from the computations of the tower-footing grounding impedances and substation grounding grid impedance obtained for different scenarios, such as conductor arrangements, types of stratified or homogeneous soils, and including or not the frequency dependence of soil electrical parameters. Then, the transient ground potential rise (GPR) will be computed for these grounding systems considering a lightning current injected at this structure.

Second-New transmission tower models can be developed combining the several tower structures (conventional and tall) with the grounding systems studied in the first part.

Third: For time-domain analysis, the improved tower model can be represented by a lumped circuit and combined with classical JMarti's line model (phase conductors and shield wires), insulator strings in the ATP software such as a full-wave black-box model. Then, the responses developed to lightning strikes (first and subsequent strokes) injected at the top of the tower or shielding wires can be properly analyzed in the time domain. Furthermore, the induced voltages at the cross-arms across the insulator strings and the GPR developed at the tower base can be also computed using the ATP program. On this basis, the BF can be adequately predicted using real characteristics of soil, tower structure, line conductors, and lightning current waveforms. Consequently, the user can estimate the occurrence of BF across the insulators string and predict outages on the power systems

The data are generated by simulations using the full-wave electromagnetic software FEKO developed by Altair Engineering utilized to solve Maxwell's equations with the numerical method of Moments (MoM). This software will compute the tower and/or tower-footing grounding impedance which can be provided in .dat files for students and researchers.

Then, the GPR can be calculated by inverse Fourier transform via MATLAB, by recursive methods implemented in MATLAB, or lumped circuit approached by the Vector Fitting technique incorporated via MATLAB programming code. Then, using the software ATP by means of LIB components, a full-wave black-box model can be developed to analyze the electromagnetic transient generated by lightning strikes on power systems. All files related to the simulations are generated in formats such as .m and .fig from MATLAB, and .acp from ATP-software. The illustrations for the power system components such as transmission towers and grounding electrodes are drawn with Draw.io or in POSTFEKO which they can be saved in these formats: .jpg, .png,.pdf, and draw.io.

The grounding electrode's structure can be also saved in CADFEKO, in the formats .igs,.sat,.stp.

All the conference papers, journal papers, and reports can be provided using the journal link or DOI number, or when it is possible, a copy will be provided in pdf in the Research gate.

Initially, measurements in the lab or fields are not predicted in this project. However, the data obtained will be compared with those available in the scientific literature.

Documentation and metadata that will accompany the data are:

Article/Conference papers: Title, subjects, funders, copyrights, methodologies, sources, references, codes of the programs.

Images in: .jpg, .fig;

CAD files (structures designed in CADFEKO): .igs,.sat,.stp format;

The project does not involve any ethical issue.

I will follow and respect the copyright and IPR rules proposed by each journal and conference in the electrical engineering area.

We have sufficient storage and no charges for additional services are need.

The security is provided by the university

 all data will be preserved in the our sites and server of the university. The data will be shared in all sites of scientific journals and proceeding of conference papers.

The long-term plan is to storage all data produced in the repository of Unicamp (http://repositorio.unicamp.br/) and FEEC page (https://www.fee.unicamp.br/).

Additionally, the data can be shared with students in graduation and/or post-graduation courses available on the professor's website.

The data will be available in journals (IEEE, Elsevier IJEPES/ EPSR, IET) and national/international conferences (Inducon, SIPDA, ICLP, SBSE, CBA). The data are published in the FEEC page (http://www.fee.unicamp.br/dse/pisso/it308), and the repository of Unicamp available for students in graduation and post-graduation courses, professors, researchers, engineers. Results are available on ResearchGate (https://www.researchgate.net/profile/Anderson-Araujo-3) and will be shared when the researcher has the rights to do it. Additionally, due to the research internship proposed with BEPE,. Prof. Behzad Kordi from University of Manitoba, Winnipeg will have the data shared when requested.

The data will vary in type (images, graphs, and papers), size and complexity (impedance, voltage, current) computed with FEKO, ATP and MATLAB.

No restrictions on the data sharing.

The reseacher is reponsible for all the data management

It is necessary:

1-) full-wave electromagnetic software FEKO/Altair Engineering

2-)MATLAB, provided to the researchers at UNICAMP;

3-)ATP-software. free software available online.

4-) IEEExplore and other digital libraries online for accessing journal articles, conference proceedings, technical brochures are provided by Unicamp;

5) computers and printers which are available in the lab.

No charges are applied by the data repositories.