

XGSLab

over and under Ground System Laboratory [September 2015]

XGSLab is one of the most powerful software packages for grounding system, electromagnetic fields, interference and lightning analysis and the only software on the market that takes into account many standards including EN and IEEE.

XGSLab includes the modules:

- GSA (Grounding System Analysis)
- GSA_FD (Grounding System Analysis in the Frequency Domain)
- XGSA_FD (over and under Ground System Analysis in the Frequency Domain)

The following table summarizes the main applications of the modules:

Application	GSA	GSA_FD	XGSA_FD
Grounding (small systems)	x	x	x
Grounding (large systems)		x	x
Cathodic Protection		x	x
Magnetic Field		x	x
Electric Field			x
Electromagnetic Interferences			x
Lightning			x

GENERAL

XGSLab has got a broad field of application because the implemented calculation model is for general use and solves the Maxwell's equations taking into account the earth effects by Sommerfeld integrals. The optimised and validated computational algorithms make XGSLab an indispensable tool for many engineering applications.

XGSLab is a fully complex number based software, completely programmed in C# language and it is a 64 bit system ready for future IT developments.

All modules include a tool for the soil analysis that can calculate a uniform or double layer soil model starting from measured soil resistivity data, with an additional soil covering layer.

The software can import from "dxf" file with single or multiple electrodes of any shape. GSA_FD and XGSA_FD need to know also the electrodes topology and then include an algorithm for the automatic recognition of the connection between conductors and the construction of the incidence matrix.

All modules include libraries with typical properties of materials and offer the possibility to choose the language (English, German, Spanish, Italian and French).

INPUT AND OUTPUT

The software requires electrical data (e.g. injected currents), geometrical data (e.g. electrodes layout) and physical data (e.g. soil resistivity). GSA_FD and XGSA_FD require additional data (e.g. operative frequency, data in order to calculate self-impedances, additional impedances, data for catenary and bundle conductors ...). All modules can take into account electrodes totally or partially covered with insulating materials or encased in concrete.

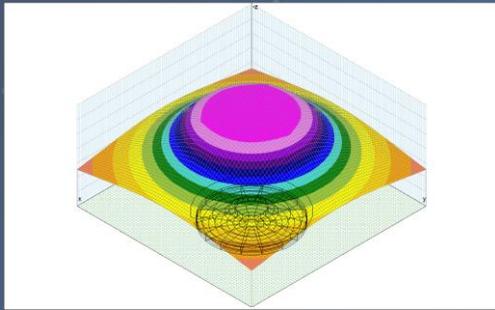
Output results depend on the module in use and in any case are available in numerical or graphical format. XGSLab produces professional colour graphics based on orthographic or isometric projections ready to be used in engineering reports.

MORE DETAILS ABOUT THE MODULES

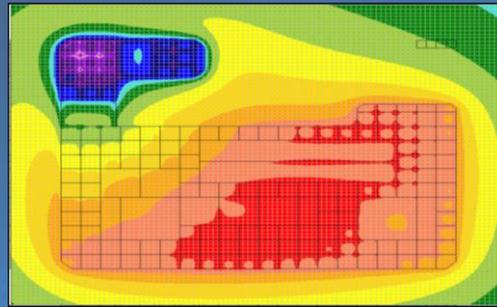
GSA is essentially a low frequency module based on the equipotential assumption, hence it is easy to use. GSA is fast in data entry and calculations and useful for investigation of GPR and leakage current, surface potential, touch and step voltage distributions in most cases.

GSA_FD takes into account self and mutual impedance and propagation effects and represents the state of the art of grounding software. GSA_FD is essential especially where the hypothesis of equipotential condition of the electrode is not acceptable. This occurs with either large grounding systems or low soil resistivity or steel conductors or high frequency. GSA_FD can be utilized for underground systems up to a few MHz and it is useful to investigate GPR, potential distribution, current distribution, leakage current distribution, surface potential, touch and step voltage and magnetic field distributions in all cases.

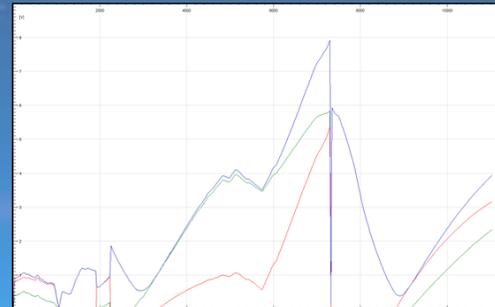
XGSA_FD includes all GSA_FD features and extends its application field to the overhead systems. In addition XGSA_FD can manage catenary and bundle conductors, it can take into account sources with imposed current or potential. Therefore, it is a real laboratory for engineering applications and for research studies. XGSA_FD can calculate electromagnetic fields and interferences between overhead systems and between overhead and underground systems and can calculate the effects of lightning and travelling waves and also fault current distribution.



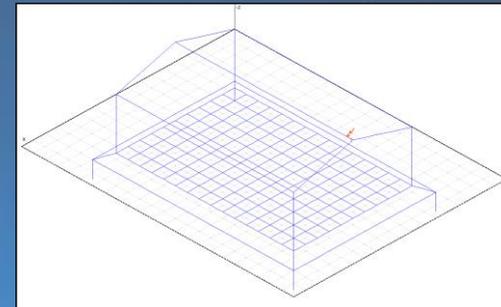
Earth Surface Potential



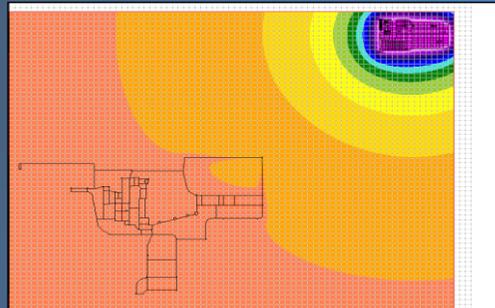
Touch Voltages



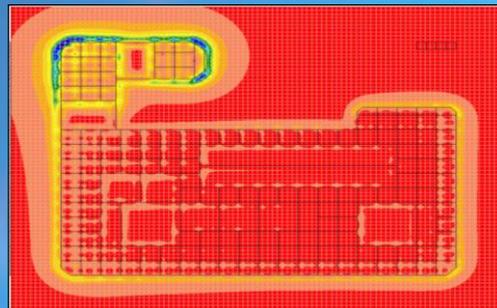
Induced Potential along the pipeline (blue magnitude, green real, red imaginary)



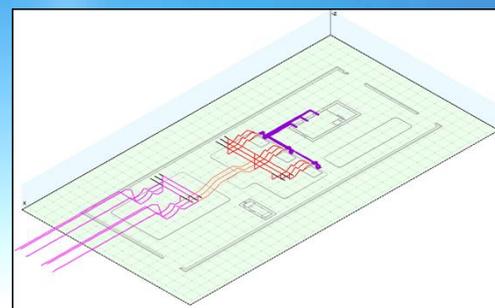
Lightning stroke on a LPS



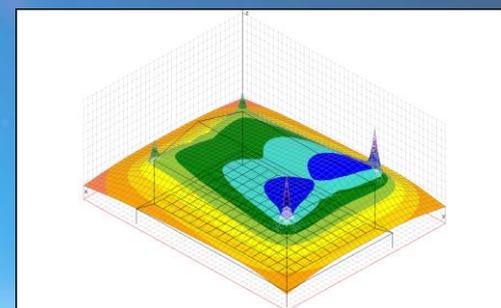
Earth Surface Potential with Floating Electrode



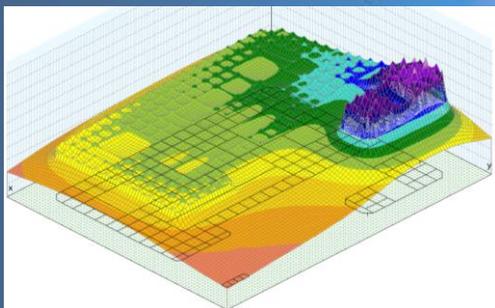
Step Voltages



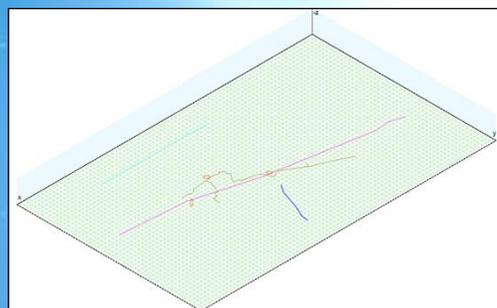
Currents along the main conductors in an electrical substation



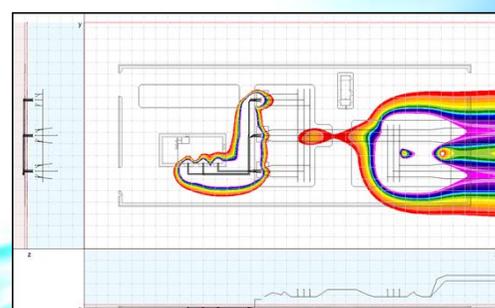
Earth Surface Potential - 1 MHz



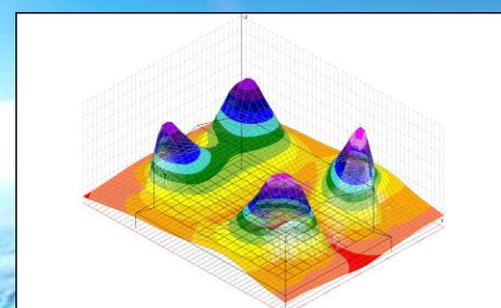
Earth Surface Potential



Interference Layout between overhead power lines and buried pipeline (green)



Magnetic field on an horizontal section (between a given range)



Magnetic Field on the soil surface - 1 MHz

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