

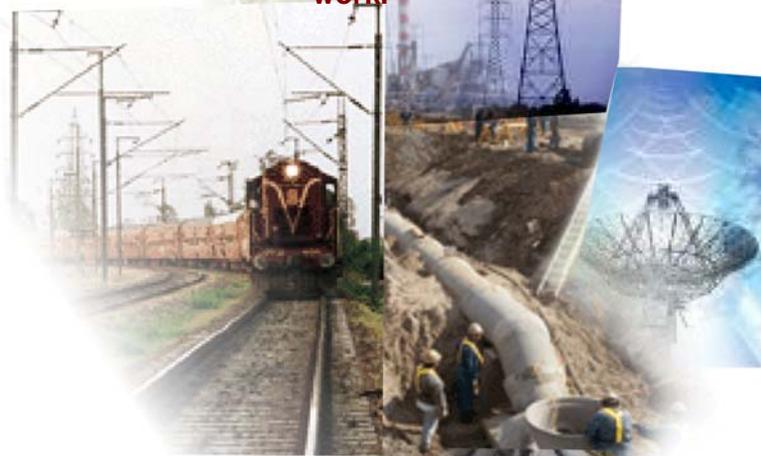
Right-Of-Way

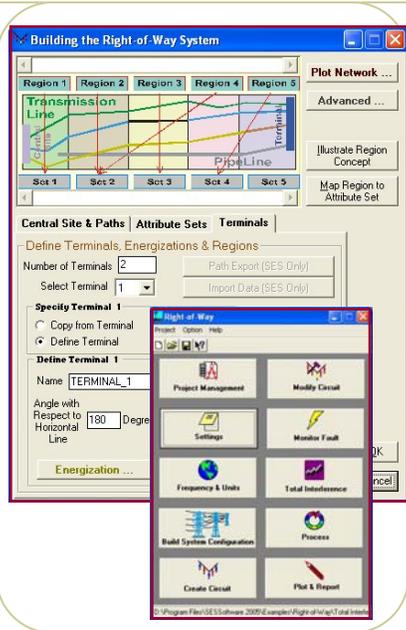
1 Automated

2 Accurate

3 Powerful

Right-Of-Way models complex arrangements of buried and aboveground conductors and computes currents and voltages resulting on every utility modeled, including conductors associated with the power line, for normal (load) and fault conditions. It models simple and multi-component conductors, including railways, communication lines, bare or coated pipelines and pipe-enclosed cable systems. Right-Of-Way, coupled with toll-free support from the world's leading R&D design team in this specialty, provides you with an array of cost-effective solutions for problems ranging from simple interference analyses to the behavior of complex networks of aboveground and buried conductors energized by fault currents. Powerful integrated and automated procedures speed up the analysis of the entire right-of-way without user intervention. Flexible data reporting and graphing utilities allow you to collect and illustrate any aspect of the results that are important for your work.





Right-Of-Way™ is an integrated software package dedicated for computing induced voltages and currents caused by electromagnetic interference from electric power lines and cables (i.e., inductive, capacitive and conductive coupling) to pipelines, railways, communication lines and other such utilities whether buried or aboveground. It analyzes accurately and automatically these interference problems and provides mitigation solutions.

Three Right-of-Way options are available:

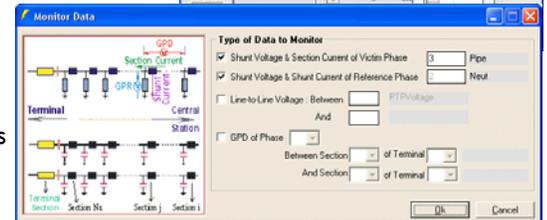
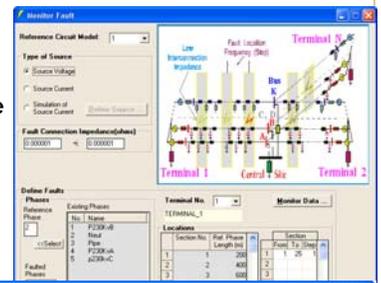
- ◆ The standard **Right-of-Way** package for the computation of inductive and capacitive coupling between power lines and other utilities.
- ◆ **Right-of-Way-Auto** automates the fault simulation process and yields an envelope of computed induced voltages throughout the length of a common-use corridor for faults occurring throughout the corridor.
- ◆ **Right-of-Way-Pro** provides a complete interference analysis and mitigation design tool with the addition of the soil resistivity analysis (RESAP) and frequency domain grounding analysis (MALZ) engineering modules of the CDEGS software package which model grounding systems including mitigation grounds and gradient control wires and compute through-earth coupling between faulted power line structures and nearby utilities while accounting for the EMF interference component accurately (total interference solution).

Key Features of Right-Of-Way

- ◆ For networks with little regularity, components can be specified individually and may be completely different from one another
- ◆ Key screens provide illustrations clearly representing the data to be entered and extensive on-line context-sensitive help is one keystroke or a mouse click away.
- ◆ Simplifies and automates the modeling of complex right-of-way configurations with the SESCAD graphical interface design package
- ◆ Automatically creates phase-to-ground faults along any transmission line at regular intervals throughout the right-of-way corridor
- ◆ Produces envelopes of the total interference stresses along the right-of-way (inductive, capacitive and conductive coupling) under both steady state and fault conditions
- ◆ Imports soil resistivity data region by region as measured along the right-of-way path

Right-Of-Way is a powerful integrated software package for the analysis of electromagnetic interference between electric power lines and adjacent installations such as pipelines, communication lines and railways

- ◆ Accommodates any arrangement of multi-phase conductors
- ◆ Computes victim circuits (such as pipelines, railway, communication lines) shunt potentials, longitudinal and leakage currents, tower potentials and earth injection currents, etc., along the right-of-way



Capabilities

- ◆ Analyzes electromagnetic interference effects, currents and voltages in every span of a multi-conductor, multi-phase power network and in any neighboring victim circuits sharing the same corridor
- ◆ Ground impedances or interconnections to other conductors can be specified for any number of conductors at any number of locations
- ◆ Accommodates any arrangement of multi-phase conductors: pipe-enclosed cables, pipelines, solid, hollow, stranded and composite conductors, insulated and bare conductors, overhead and buried conductors, and irregular phase configurations. All cable conductors can have a core, sheath, armor, and arbitrary insulations
- ◆ An extensive conductor database is available to ease input operations. Add your own products to the databases at any time

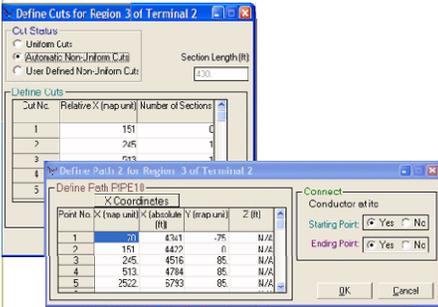


It is a simple task to create a right-of-way network using AutoCad, MicroStation or any other compatible CAD files. Otherwise, use maps or aerial photos to trace the Right-Of-Way rapidly.

Conductor Fields		Real Part		Imaginary Part	
Conductor Name	Cross Section (Square)	R _{DC} (Ohm/A.m)	R _{AC} (Ohm/A.m)	GMI (Meters)	
Alkplate	300	0.0542954	0.0854325	0.0127102	
Althen	1272	0.0729509	0.0763605	0.0135636	
Alunbed	2156	0.054704	0.0289959	0.0178918	
Alunsey	1113	0.0528016	0.0538017	0.0126797	
Alunsk	1431	0.040762	0.0425638	0.0143886	
Alunna	2032	0.036	0.036	0.0143886	
Alun	968	0.04444	0.04444	0.0143886	

The standard Right-of-Way user interface consists of several main integrated modules:

- ◆ Project management, setup and general information & data (Project, Setup & Settings)
- ◆ Building the right-of-way system (Build System Configuration)
- ◆ Creating the original circuit model (Create Circuit)
- ◆ Manipulating a Right-Of-Way circuit input (or SPLITS input) compatible file (Modify Circuit)
- ◆ Assigning and monitoring faults along a right-of-way (Monitor Fault)
- ◆ Creating the so -called Total AC interference model that combines inductive and conductive interference in one step analysis (Total Interference)
- ◆ Processing the input data and carrying out the required computations (Process)
- ◆ Plotting and reporting all system input data and computation results (Report)

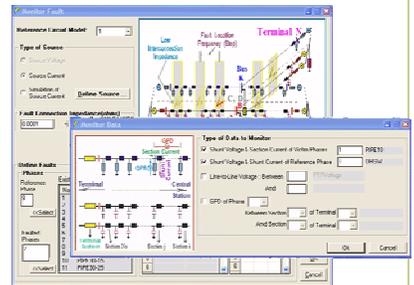


The **first** module takes care of various aspects of project management and allows you to modify the limits of various parameters such as number of terminals, number of conductors, etc. You can also specify common system data such as system of units and power frequency.

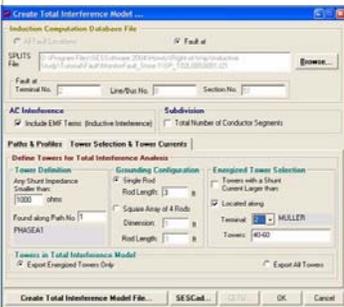
The **second** module builds the right-of-way circuit model through a series of intuitive windows interfaces, then automatically computes the required line parameters to produce the complete input data file that is then ready to energize, either by normal load currents or fault currents.

The **Create Circuit** module builds the original circuit model of the network that will be used to carry out the computations.

The **fourth** module retrieves data from, and makes modifications to a SPLITS-compatible input file initially produced by Right-of-Way or any other application of the SES software packages.



The **fifth** module in Right-of-Way-Auto allows the user to automatically model faults along a transmission line, at any combination of group of sections (spans), with the possibility to define arbitrary section increments between applied faults. The program will generate summary files containing useful information about the monitored "victim" phase conductor (pipeline, railways etc.) and a reference phase conductor (ground-wire, etc.) at every span (section) of the circuit.



The **sixth** module allows a user to automatically create a conduction computer model of the grounding systems (including tower structure grounds) and mitigation wires along the target right-of-way that may have an influence on the conductive interference with the full EMF (induction) components integrated in the model. The EMF components are used to account for the induced effects on a victim line due to currents flowing in phase conductors, overhead ground wires or other victim lines. They represent the inductive interference that was calculated by the circuit model computation engine. As a result, the conductive grounding analysis engineering module gives the total interference level (conductive and inductive components) under fault conditions rather than the conductive component only.

The **Process** module is in charge of calculating the inductive & capacitive interference levels during load or fault conditions as well the total interference inductive and conductive levels during fault conditions, including current and voltage distributions.

Finally, the **Plot & Report** module provides various utilities, e.g.: system input & computation results reporting, circuit plotting and envelope curve plotting.

Plotting and Reporting

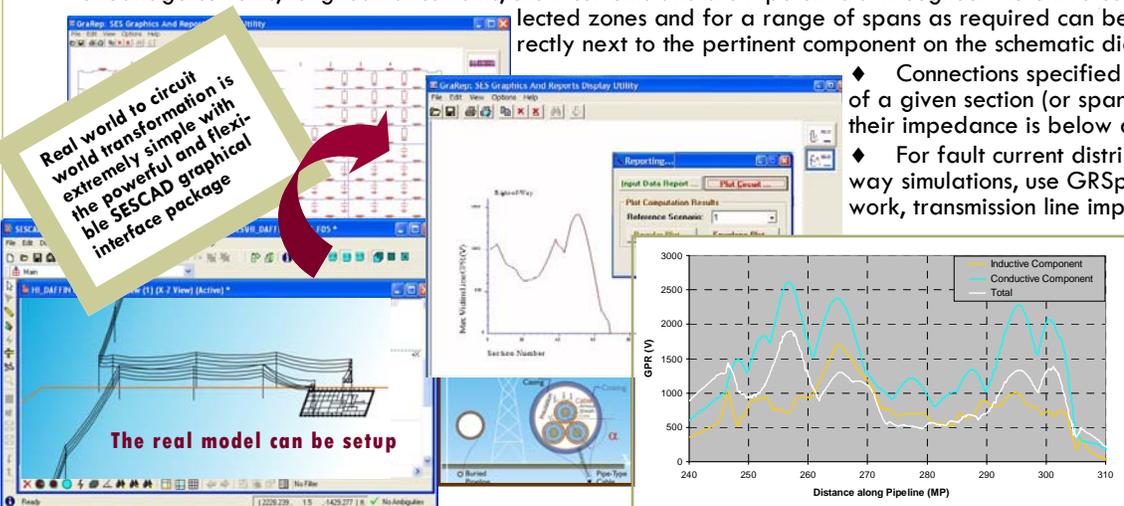
Viewing and checking components of the circuit model is a simple, visually rewarding task with Right-Of-Way tools.

- ◆ The entire circuit or only the parts of interest can be plotted to help you focus on the most important zone of the right-of-way
- ◆ The leakage currents, longitudinal currents, shunt currents and shunt potentials throughout the entire conductor network or at selected zones and for a range of spans as required can be plotted or displayed directly next to the pertinent component on the schematic diagram of the network

- ◆ Connections specified between the various phases of a given section (or span) are also displayed when their impedance is below a specified threshold value

- ◆ For fault current distribution analyses or right-of-way simulations, use GRSplits to plot multiphase network, transmission line impedances, voltages, and currents as a function of distance or span number

- ◆ Computation results, such as GPR, longitudinal or shunt currents can be exported to a word or spreadsheet processor easily and plots can be produced in most popular formats



Documentation

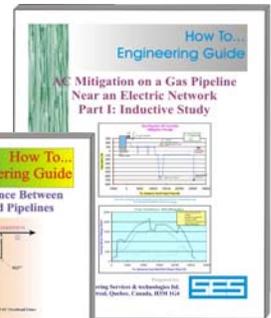
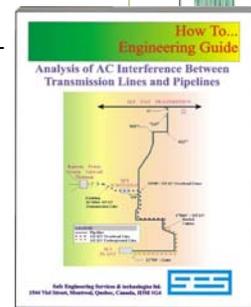
Documentation is a critical item when dealing with engineering software. Potential users should examine thoroughly the documentation in order to properly evaluate a software package.

SES regularly publishes technical papers in Transactions journals and presents papers at various international conferences on engineering topics related to power system grounding (including analysis of transients and lightning), EMF studies and AC interference. SES also undertakes landmark applied R&D studies in these areas. These studies have not ever been undertaken before with the accuracy and detail of which our modern computer-based technology is capable

today. This R&D is now being distilled into "How To..." engineering manuals at a level of detail designed for both novices and advanced users who encounter similar problems and wish to model them with the SES software. These unique, detailed, step-by-step "How To..." engineering manuals guide you through the most complex analysis and design projects (both the engineering concepts, and the use of the software are described).

SES distributes a complete documentation set with its software in electronic form (on CD-ROM) and provides hard copy as well. Furthermore, significant information on new or updated

software is made available on the SES web site. The main documentation set supplied with the software package consists of Quick Installation and System Requirements sheets and booklets, a Getting Started manual, more than ten "How to..." engineering manuals, on-line context sensitive help, Annual Users' Group Meeting Proceedings, Users' Group Newsletters, and an extensive Technical Reference document containing a detailed description of the analytical methods used by the various SES engineering modules.



Step-by-step Engineering How-to ...

Accuracy and Validation

If there is an item which is of primary importance when dealing with engineering software, it is definitely validation & accuracy. Extensive scientific validation of the software by means of field tests and comparisons with analytical and published research results is documented in hundreds

of technical papers published by the most reputed international journals. Each module has been tested to insure that it produces the correct results for a large number of cases documented at SES, which include several fundamental cases available to users on CD-ROM.

The evolving software is continuously validated over the years using the following three well documented mechanisms (visit our Web site for more detailed information).

- ◆ *Field Tests and Experimental Scale Models*
- ◆ *Comparisons with Scientific Published Results*
- ◆ *Comparisons with Similar Programs Using Completely Different Techniques*

Technical Support & Software Updates

As part of its ongoing commitment to provide state-of-the-art analysis and design tools, help to use the software as effectively as possible and information on recent R&D advances, SES invests considerable resources in its software development and analytical R&D programs. SES disseminates new technological developments in two ways: by means of engineering applications support and by means of software updates, enhancements and additions.

SES' legendary international toll-free hotlines connect you instantly to SES' software and engineering support team via telephone, fax, and Internet, no matter where you are on this planet. The support covers a wide range of engineering and software topics and is not restricted by time limits. Telephone access is toll-free for all international users. It's like having

the world's foremost experts at your side any time you are ready to tackle your most challenging study or design. SES provides all licensees with support covering installation, updates, and technical support, as well as extended engineering support. SES realizes that veteran software users are becoming overloaded or transferred to other positions as a result of the present economic turmoil and therefore is diligent in providing extensive assistance to new users who must be introduced to the software to share some of the load. Extended technical support is not only on the use of the software but includes also assistance on engineering topics related to the fields encompassed by the software whether or not SES software is being used.

The SES software maintenance and update service provides subscribers with new technology in the form of new software (at least two major software releases per year, with instantaneous access to updates and enhancements through FTP downloads or by visiting SES Internet Web Site), along with comprehensive telephone / fax / Internet support to users requesting assistance in installing or running the software. Extended engineering support is "topics-oriented" and covers help in solving challenging problems that users encounter in their daily work, whether it involves use of the software or not. In addition, SES personnel provide engineering seminars held at various locations, including workshops at customers' sites.

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