# 4 Using SESTLC: A Simplified AC Induction and Field Calculation Program

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## 4.1 Introduction

The TLC software package is a Transmission (and distribution) Line Calculator for rapid EMF, line parameter, and induced voltage estimates. It can be used to quickly estimate line parameters, electric fields, and magnetic fields associated with arbitrary configurations of parallel transmission and distribution lines. It also estimates induced voltages and currents on other parallel metallic utilities, such as pipelines and railways. TLC has been designed with simplicity in mind, providing much useful information with minimal data entry, when applied to simple system configurations. This can be very helpful for preliminary analyses of more complex systems. Keep in mind that for more complex systems or more detailed studies, the Right-of-Way software package or the HIFREQ engineering module are recommended.

The main functions of TLC are summarized as follows:

- (1) Line parameter calculation;
- (2) Electric field calculation;
- (3) Magnetic field calculation;
- (4) Steady-state condition inductive interference calculation;
- (5) Fault condition inductive interference calculation.

A typical example is given below to demonstrate how to use SESTLC to compute various quantities mentioned above.

## 4.2 A Typical Example

Figure 4-1 shows a typical configuration of a transmission system with a pipeline (refered to as the **victim line** in TLC instead of pipeline because it can be a communication line or a rail) parallel to the transmission line. The parallel length of the pipeline with the transmission line is 10 km. Both the left and right continuous lengths are 5 km. The cross section of the transmission line and pipeline configuration is illustrated in Figure 4-2. Each of the phase wires consists of four solid copper conductors bundled together in a rectangular shape. The conductor radius is 0.01 meter, and the size of the rectangle is 1 meter by 1 meter. The cross section and physical dimensions of the transmission line are shown in Figure 4-2.



Figure 4-1 A Typical Transmission Line System with Pipeline.



Figure 4-2 The Cross-Section of the Transmission Line Configuration.

## 4.3 SESTLC Interface Overview

Let's start TLC now. A Start Page screen will appear as shown in Figure 4-3. There are several ways to start a *new project*. Please refer to the SESTLC on-line help for more information. The simplest way is to click on the **SESTLC** icon on the toolbar. The *New Project Wizard* will be invoked as shown in Figure 4-4.

Let's start with the **Steady State Induction** computation. Now the *New Project Wizard* will walk us through the whole process of data entry. At any time you can interrupt the data entry session on the *New Project Wizard* dialog screen by clicking on the Finish button. This will bring you back to the standard screen, **General** page in this case, as shown in Figure 4-5. We can see that the standard screen offers a menu bar, a toolbar and a status bar. Below the toolbar, there are two panels. The left panel gives quick access to the various computation types that can be selected from the dropdown menu. The data items (pages) corresponding to each computation type is refreshed when you switch from one type to another. The right panel displays the input data pertaining to the page you have selected (by clicking on the Select Page item).



Figure 4-3 The TLC Start Page.



Figure 4-4 The TLC New Project Wizard.

<table-of-contents> SESTLC - J:\Employees</table-of-contents>	s\JINXI\Yixin\2004L	IGM\TC_DemoSteadyInduction.F0	)5	
File <u>V</u> iew Tools Help				
🚯 New Project 🛛 😅 Open Pr	roject 📕 Save	🕼 Previous Page 🖨 Next Page	🔇 Process	💫 View Report
Computation Type (*) Steady State Induction (*) Select Page	General Describes the cas Job Identification and V Job ID	e being modeled and basic system param Vorking Directory DemoSteadyInduction	eters.	
다 General 述 Victim Circuit i Cross Section	Working Directory Run Identification — O Use JobID O Specify	J:\Employees\JINXI\Yixin\2004L SESTLC SI STUDY	JGM	
<ul> <li>♥ Energization</li> <li>➡ Soil Type</li> <li>♥ Advanced</li> </ul>	Case Description — This case is designed on a pipeline under s Case Description — This case is designed on a pipeline under s System Frequency System Frequency System of Units — Dimensions in	d to compute the induced potential teady-state conditions.	Meters	
Ready				

Figure 4-5 TLC Standard Screen: General.

Let's now go through all the standard screens (pages). The General page allows you to define the common general project information such as Case Description, System Frequency and System of Units.

## 4.4 Steady State Induction Computations

In this section, the steady-state induction computation using TLC is presented. The cross section of the transmission line with the pipeline is shown in Figure 4-2. The 3D view is similar to that shown in Figure 4-1.

The Victim Circuit Page is shown in Figure 4-6. Here we specify the parallel length, left continuous length, and right continuous length of the pipeline as defined in the figure in the screen. The pipe coating resistance, left and right ground impedances of the pipe are also specified here.

The Cross Section Page is shown in Figure 4-7. Cross section of the common corridor of the transmission line and the parallel pipeline is specified here. Line characteristics such as relative resistivity and permeability as well as inner and outer radius of phase conductors, neutral wires, and pipeline are also specified here. The

neutral conductor in this case is 1/2 EHS-AG steel conductor. The pipeline radius is 0.127 m (10") and its thickness is 7 mm. The pipeline is buried at a depth of 1.5 m.

Figure 4-8 shows the Energization Page where the energization currents of the phase conductors are specified.

Figure 4-9 shows the Soil Type Page where the soil resistivity is specified.

The Advanced Page is shown in Figure 4-10. Note that 'Show Plots' here requests that the plots be displayed on screen immediately after the computations have been performed rather than be saved in files which can be displayed later. TLC presents computation plots using the Array Visualizer application.

To run TLC, simply click **Process** in any standard screen. In this case, induced pipe potential will be displayed on screen as shown in Figure 4-11. The two peaks in the potential curve correspond to the two locations where the pipe deviates from the transmission line (the two ends of the Parallel Length). The lowest potential in the middle of the curve corresponds to the middle point of the pipeline, which is as expected.

Figure 4-12 shows the induced current flowing in the pipeline. It can be seen that the maximum current appears at the middle point of the pipe, as expected.



Figure 4-6 TLC Standard Screen: Victim Circuit.

<b>SESTLC - J:\Employees</b> ile <u>Vi</u> ew Tools Help	\JINXI\Yixin\2004L	JGM\TC_	Demo	SteadyInduction	i.F05	
🖇 New Project 🛛 🚘 Open Pro	oject 🔚 Save	🗢 F	revious	Page 📣 Next Pag	e 🛛 👩 Proces	s 🛛 💫 View Repo
Computation Type 🚷	Cross Se	ctio	n	7 else view of the tr		ie i llue el un
Steady State Induction 🔽	wires, neutral/shie	Id wires.	s the As	∠ plan view or the tr	ansmission system,	i.e.: the phase
Select Page	Phase Wires Neutra	al/Shield W	/ires V	/ictim Line		
🗳 General	Phase Wire Phase Numbe	er Y(m)	Z (m)	Outer Radius (m)	Inner Radius (m)	Relative Resistivity (
🖉 Victim Circuit	1	-10.5	25.5	0.01	0	1
📰 Cross Section	1	-9.5	24.5	0.01	0	1
O Energization	2	-0.5	24.5	0.01	0	1
🛤 Soil Type	2	0.5	25.5 24.5	0.01	0	1
🏹 Advanced	2 3	-0.5 9.5	24.5 25.5	0.01 0.01	0 0	1
	3	10.5 10.5	25.5 24.5	0.01 0.01	0	1
	3	9.5	24.5	0.01	0	1
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	z į	Ţ		Neutral Wire Phase Wire Victi	m line Y	
adu						

Figure 4-7 TLC Standard Screen: Cross Section.

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File <u>V</u> iew Tools Help									
🚯 New Project 🛛 🗃 Open Pro	oject 🔚 Save	🗢 Previous Page 🖨 Next Page	🍏 Process 🛛 💫 View R	leport					
Computation Type 🔿 📤	Energizat	ion							
Steady State Induction 💌	This screen specifies conditions for electric	s the voltages and currents that apply c and magnetic field computation and	to each phase during normal load I steady-state induction computation.						
Select Page	- Define Currents	⊇ <u>C</u> artesian							
🗳 General 🗧	Phase Number	Magnitude of Current (A	) Angle of Current (Degree)						
🖉 Victim Circuit	▶ 1 2	1000 1000	0 -120						
🔛 Cross Section	3	1000	120						
🛇 Energization 📃									
🛤 Soil Type									
🖓 Advanced									
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Ready				.:!					

Figure 4-8 TLC Standard Screen: Energization.



Figure 4-9 TLC Standard Screen: Soil Type.

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File <u>V</u> iew Tools Help									
🎼 New Project 🖙 Open Project 🔚 Save 🛛 🗢 Previous Page 🧼 Next Page 🛛 🚫 Process 🔍 View Report									
Computation Type 🔿 🏠	Advanced								
Steady State Induction 💌	Specify advanced co	omputation settings.							
Select Page	Line Parameters Options								
🗳 General 🗉	Sequence Com	ponents							
🛃 Victim Circuit	🗹 Bundle Reduction	on							
Cross Section	Graphics Options								
O Energization	<ul> <li>Show Plots</li> </ul>								
🛱 Soil Type	🔘 Do Not Show P	O Do Not Show Plots							
🏹 Advanced	(plots will be save	ed automatically)							
Ready									

Figure 4-10 TLC Standard Screen: Advanced.



Figure 4-11 Induced Potential on the Pipeline.



Figure 4-12 Induced Current Flowing in the Pipeline.

#### 4.5 Fault Condition Induction Computations

In this section, the fault condition induction computation option using TLC is presented. The system modeled is exactly the same as in the steady state induction calculation described in the previous section. The fault location is assumed to be at the middle point of the parallel length of the pipeline (as shown in Figure 4-2).

Figure 4-13 shows the Victim Circuit Page for Fault Condition Induction calculations. The difference between this page and that for Steady State Induction (Figure 4-6) is that the field for specifying the Fault Location is now active. The fault location is defined by its distance from the left end of the parallel length to the fault location. It can also be seen that the Data Items (Pages) on the left panel are different, the new ones being Terminal 1, Terminal 2, and Central Site. The Central Site Page is shown in Figure 4-14. The faulted phase and the Grid Impedance are defined here. The Grid Impedance is usually a tower ground resistance for faults at a tower. It can also be the ground impedance of the substation grounding grid for faults at a substation. In this case, it is a 30  $\Omega$  tower ground resistance.

The Energization Page for Steady State Induction computations is replaced by the Pages, Terminal 1 and Terminal 2. For Fault Condition Induction, we assume that there are always currents coming from both sides of the fault location. Figure 4-14 shows the Terminal 1 Page. The fault current from Terminal 1 is specified here (4000 A), as well as the number of sections (tower spans), span length, tower ground impedance and ground impedance of Terminal 1. The Terminal 2 Page is exactly the same as the Terminal 1 Page in our case.

Again we run TLC by clicking the Process button on any standard screen. The following plots will be generated. Figures 16 and 17 show the tower shunt potentials and currents. Figure 4-18 shows the induced potential on pipeline. It is at its maximum at the fault location, as expected. Figure 4-19 shows the conductively transferred potential at the pipeline location due to the potential rise of the towers. Note that the title of this plot, victim line potential magnitude, is not very clear. In fact, this is the conductive component of the pipeline coating stress voltage. The total stress voltage, which is the sum of the induced pipeline potential (inductive component) shown in Figure 4-18 and the conductively transferred potential at the pipeline location due to the potential rise of towers (conductive component) shown in Figure 4-19, taking into account their relative phase angles, is shown in Figure 4-20. Figure 4-21 shows the induced current flowing in the pipeline.

It can be seen that the Induction Calculation option offered by TLC requires only the essential input data, while producing the desired results such as induced pipeline potential and coating stress voltage. Note that the Victim Line is used instead of Pipeline because it can be a communication line or a rail. Only one victim line can be analyzed at a time. This limitation will probably remain for some time. Also, a non-parallel victim line cannot be modeled at present. This option will be available in future releases.

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File <u>V</u> iew Tools Help					
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Computation Type 🔿	Victim Cire	cuit			
Fault Condition Inductior 🗸	The victim line or circu that is subject to induct	uit is a conductor or a tion.	metallic path (suc	h as pipeline, railwa	y etc.)
Select Page	Parallel Length (m)	10000	Coating Res 4000	istance Ohm-meter <sup>2</sup>	~
🗳 General	Fault Location (m)	5000	Left Ground	Impedance (Ohms)	
🖉 Victim Circuit	Left Continuous Length (m)	5000	1000000	+i 0	
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🖶 Terminal 1		Fau	lt		
🖶 Terminal 2	TERMINAL 1	4		TERMINA	AL 2
🛤 Soil Type	5   F.	ult Distance			
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M Advanced	Port	Victim Ci	reuit	Port	
	$\frac{S}{R_L + jX_L}$		R	± ź	
	Left Ground Impeda	nce	Right Ground I	mpedance	
Ready					

Figure 4-13 The Victim Circuit Page for Fault Condition Induction.

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File ⊻iew Tools Help				
🚯 New Project 🛛 🗃 Open Pr	oject 🔛 Save	🗢 Previous Page 🖨 Next Page	🌀 Process	💫 View Report
Computation Type 🔿	Central S	ite Data Specificat	ion	
Fault Condition Inductior 💌	impedance is define	the location where the transmission line r d here.	auit nappens. I ne <u>c</u>	jrouna
Select Page	Faulted Phase	3		
🗳 General	Central Site Name	CENTRAL_SITE		
Victim Circuit	Grid Impedance (Ohm)	<b>30</b> +i O		
📰 Cross Section		Early Location		
🖶 Terminal 1		Fault Location		
🖶 Terminal 2		*		Skywire
🛱 Soil Type		- A		PhaseWires
Central Site	TERMINAL	<u>LAR</u>	TERMIN	AL
🖓 Advanced	1	Rs+jXs	2	
		Ŧ		
Ready				

Figure 4-14 The Central Site Page.

SESTLC - J:\Employees	JINXI\Yixin\2004U	IGM\TC_DemoFau	ltInduction.f05		
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🚯 New Project 🛛 🗃 Open Pr	roject 🔚 Save	🗢 Previous Pag	e 📣 Next Page	👩 Process	💫 View Report
Computation Type 🔿	Terminal	1 Specific	ation		
Fault Condition Induction	During fault conditi is represented by a	ions, fault current flow terminal.	is from both sides of t	he fault location. Ea	ch side
Select Page	Terminal Name GREENBAY	]	Earth Impedance	(Ohms) +i <b>O</b>	
🗳 General	Section				
Victim Circuit	Number of Sections	Span Length (m) 400	Tower Ground Im 30	pedances (Ohms) +i 0	٦
🔛 Cross Section	Source				
뤜 Terminal 1	Connection Impedance	(Ohms)			
👼 Terminal 2	0 +j	0		Section J of Nx	
🛤 Soil Type	Fault Current				<b>x</b>
🚱 Central Site	O <u>C</u> artesian	⊙ <u>P</u> olar	Neutral Connection Impedance	SI LE	pan ngth
M Advanced	Fault Current (A) 4000 <	0	Rn+jXn Terminal Earth Impedance	Rshunt+j Current Source	Xshunt
Ready					

Figure 4-15 The Terminal 1 Page.



Figure 4-16 Tower Shunt Potential.







Figure 4-18 Induced Potential on Pipeline.



Figure 4-19 Conductively Transferred Potential at Pipeline Location Due to Potential Rise of Towers.



Figure 4-20 Potential Coating Stress Voltage.



Figure 4-21 Induced Current Flowing in the Pipeline.

#### 4.6 Line Parameters Computations

In this section, the line parameters computations option using TLC is presented. The line parameters, mainly the series (self) and mutual impedance matrices, of the transmission line are essential in this study. The line parameters include conductor-based parameters, and the phase based parameters. In the phase based parameter computation, the conductors in the same phase are treated as one equivalent conductor. This procedure is called bundle reduction.

The symmetric sequence components of impedances are used in the unbalanced system operation analysis. In order to compute these parameters, the effect of the overhead ground wires should be included in the phase based parameters. This procedure is called ground wire elimination. After ground wire elimination, the sequence components are computed.

Figure 4-22 and Figure 4-23 show the data entry screen of the phase wires and the overhead ground wires data. Figure 4-24 show the Soil Type page. This screen allows you to specify the characteristics of a uniform soil. A 100  $\Omega$ -m soil resistivity value is used in this example.

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C	ross Se	ecti	on					
T	he cross secti ires.	ion de	scribes	the X-Z plan view	w of the transmis	sion system, i.e.: th	e phase wires, neutral/shield	
Phase	Wires Neutr	al/Shie	eld Wire	s				
Phas	e Wire							
	Phase Number	Y (m)	Z (m)	Outer Radius (m)	Inner Radius (m)	Relative Resistivity (		
•	1	-10.5	25.5	0.01	0	1		
	1	-9.5	25.5	0.01	0	1		
	1	-9.5	24.5	0.01	0	1		
	1	-10.5	24.5	0.01	0	1		
	2	-0.5	25.5	0.01	0	1		
	2	0.5	25.5	0.01	0	1		
	2	0.5	24.5	0.01	0	1		
	2	-0.5	24.5	0.01	0	1		
	3	9.5	25.5	0.01	0	1		
	3	10.5	25.5	0.01	0	1		
	3	10.5	24.5	0.01	0	1		
	3	9.5	24.5	0.01	0	1		
Z 1			A Ne	eutral Wire Phase Wire	ine Y			
Ein	ish	Re	set			< Back	<u>N</u> ext > <u>C</u> anc	zel 📄

Figure 4-22 Cross Section Page – Phase Wires Data Entry Screen.

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	Cross S	ecti	on					
	The cross sec wires.	tion de:	scribe	es the X-Z plan	view of the trar	nsmission system, i.e.: the p	hase wires, neutral/shie	ld
Ph	ase Wires Neu	tral/Shie	eld Wi	res				
Ne	eutral/Shield Wi	re						
	Phase Num	Y(m) 2	Z (m)	Outer Radius (	Inner Radius (	Relative Resistivity (Ohm-M	Relative Permeability (	
Þ	0	-5 3	80	0.0063	0	12	250	
	0	5 3	80	0.0063	0	12	250	
	z A			Phase Wire Viction	m line			
	Einish	<u>R</u> e:	set			< Back	Next>	Cancel

Figure 4-23 Cross Section Page – Neutral/Shield Wires Data Entry Screen.

🖶 New Project Wizard				
Soil Type				
Enter the characteristics of a uniform soil h	iere.			
Uniform Soil	Characteristics			
Resistivity (Ohm-Meters)	Relative Permeability (p.u.)	1		
Relative Permittivity (p.u.) 1				
Psoil Esoil μsoil				
<u>Finish</u> <u>R</u> eset	(	< <u>B</u> ack	<u>N</u> ext >	Cancel

Figure 4-24 Soil Type Page.

The last page in the wizard is the 'Advanced' page (Figure 4-25). The check box 'Sequence Components' is automatically selected by default. This feature will invoke bundle reduction and ground wire elimination. The Graphics option is disabled since the line parameters computation will generate a report only.

🔜 New Project Wizard 🛛 💦 🔀	
Advanced	
Specify advanced computation settings.	
Line Parameters Options	
Sequence Components	
Bundle Reduction	
Graphics Options	-
Show Plots	
O Do Not Show Plots	
(plots will be saved automatically)	
Einish Reset Cancel	

Figure 4-25 The Advanced Page.

Click on the 'Finish' button to complete the *New Project Wizard* dialog, and this will bring you to the main screen. You can click on the 'Process' button to start the computation.

When the computation is completed, the 'View Report' icon on the toolbar is activated. Click on it, the report file (TC\_Jobid.f09) will display as shown in Figure 4-26.



Figure 4-26 The Computation Report Screen.

#### 4.7 Electric and Magnetic Field Computations

In this section, the electric and magnetic field computation option using TLC is presented. First, the Cross Section page is identical to the one shown in Figures 22 and 23. The Energization page is shown in Figure 4-27, where you can specify the voltage and current for all the phases. The phase currents magnitudes are 1000 Amperes and the corresponding phase angles are 0, 120 and 240 degrees respectively. The voltages magnitudes are 100,000 Volts and the corresponding angles are 0, 120 and 240 degrees respectively.

🛃 N	ew Project Wizar	ď				X
E	nergizatio	o <b>n</b>				
	This screen specifies	s the voltages and currents t	hat apply to each phase	during norma	al load conditions f	or
Defi	electric and magnetic	c neid computation and stee	ay state induction comp	aramon.		
Dem	le Currents					
		<u>Cartesian</u>	Polar			
	Phase Number	Magnitude of Current (A	Angle of Current (Degre			
	1	1000	0			
	2	1000	120			
	3	1000	240			
*						
Defi	ne Volteges					
	ne venages					
		<u>C</u> artesian @	) <u>P</u> olar			
	Phase Number	Magnitude of Voltage (	Angle of Voltage (Degr			
	1	100000	0			
	2	100000	120			
1	3	100000	240			
*						
	Einish Re	eset	<	Back	Next>	Cancel

Figure 4-27 The Energization Page.

The presence of the tower conductors will affect the distribution of the electric field. Figure 4-28 shows the Tower Conductors page that allows you to specify the tower conductors coordinates. Typically, the tower

conductors at the locations of observation points at which the electric and magnetic fields will be calculated are of interest.

Ne	w Project	Wizard										
Т	ower	Condu	ictors			- Angel		The second second				
T	ower structu f each segm	res are mod ent here.	leled as a m	esh of straig	ght metallic o	conductor se	gments. Ente	r the coordina	tes			
Cor	ductor Segr	nents										
	X Start (m)	Y Start (m)	Z Start (m)	XEnd (m)	YEnd (m)	Z End (m)	Radius(m)	~				
•	0	-30	30	0	-30	25	0.02					
	0	-30	25	0	-30	20	0.02					
	0	-30	20	0	-30	15	0.02					
	0	-30	15	0	-30	10	0.02					
	0	-30	10	0	-30	5	0.02					
	0	30	30	0	30	25	0.02					
	0	30	25	0	30	20	0.02					
	0	30	20	0	30	15	0.02					
	0	30	15	0	30	10	0.02					
	ů.	30	10	0	30	5	0.02					
*						Ŭ	0.02	~				
Conductor Segmentation												

Figure 4-28 The Tower Page – Tower Conductors Data Entry Screen.

Next, you can specify the observation points at which the electric and magnetic field values are to be calculated by defining them in the Computations page as shown in Figure 4-29.

First, let's specify an observation profile. In this case, the profile is composed of 101 observation points and is located in the plane of the cross section of the line (Y-axis). The X-axis is along the direction of the line. The Z-axis represents the height of the profile which is 10 meters above ground. The reason to place the profile at this height is that we want to show a non-zero X and Y components plot of the electric field.

To define a surface profile, click on the **Surface** button as shown in Figure 4-29. The surface profile defines an array of observation profiles contained within a plane by copying and shifting the defined profile 19 times along the X-direction and at intervals of 1 meter as shown in Figure 4-30.

The Advanced Page is shown in Figure 4-31. Note that 'Show Plots' here requests that the plots be displayed on screen immediately after the computations are completed rather than be saved in files which can be displayed later.

📰 New Project Wizard 🛛 💦 🔀													
Computations													
	Specify the location of observation points at which the electric and magnetic fields should be computed.												
Profiles Points													
Profiles													
	No. of Point	X Start (	Y Start (	Z Start (	dX (m	dY (m	dZ (m						
•	101	0	-50	10	0	0	0	Surface	1				
*													
·													
	Z∔	Po	int 2										
	P	sint 1	1	oint j									
		•	Y										
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		Xi											
			/										
	0	5	<u> </u>		*								
					-								
<u>[</u>	inish	<u>R</u> es	et			< <u>B</u> ac	:k	Nex	t >	Can	cel		

Figure 4-29 The Computations Page – Data Entry Screen for Observation Points & Profiles.



Figure 4-30 Data Entry Screen to Specify a Surface Profile.

🔚 New Project Wizard 🛛 🔀
Advanced
Specify advanced computation settings.
Line Parameters Options
Sequence Components
Bundle Reduction
Graphics Options
Show Plots
O Do Not Show Plots
(plots will be saved automatically)
Einish Reset (Back Next) Cancel

Figure 4-31 The Advanced Page

Simply click the **Process** button in any standard screen. In this case, the first plot shown in Figure 4-32 will be displayed on screen as well as a dialog message box that requires user's confirmations will be displayed as is shown in Figure 4-33. There will be a total of 8 plots generated for the electric and magnetic fields computations. In this example, only 2 plots will be shown, the Y-component of the magnetic field (Figure 4-32) and the X-component of the electric field (Figure 4-34). Note that the X-component of the electric field is zero where there are no tower conductor present. The effects of the tower conductors can be seen clearly in the figure.

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Elle	<u>E</u> dit	<u>V</u> iew <u>S</u> etting	s <u>C</u> olors	Palett	e <u>D</u> ata	Help													
	2 🖬	X 🖻 🖻 é	∋  <b>?</b>   №	1	ť 🖬 X	戻 🛛		R											
	Profile Numbers														^				
		1	2		3		4		5	6		7		8	9		10		
- He	1	0.605509	0.605	509	0.6055	39	0.605509	0.	605509	0.60550	09 0	.605509	0	0.605509	0.6055	09	0.605509		
1 <u>5</u>	2	0.640154	0.640	154	0.6401	54	3.640154	ο.	640154	0.6401	54 0	0.640154	0	0.640154	0.6401	54	0.640154		
<u></u>	3	0.677409	0.677	409	0.6774	39	3.677409	ο.	677409	0.67740	09 0	.677409	0	0.677409	0.6774	09	0.677409		
- ē	4	0.717511	0.717	511	0.7175	11	3.717511	0.1	717511	0.7175	11 0	.717511	0	0.717511	0.7175	11	0.717511		
P4	5	0.760722	0.760	722	0.7607	22	3.760722	0.	760722	0.76073	22 0	.760722	0	0.760722	0.7607	22	0.760722		~
5									ļ									2	_
				6.	200 4.775 3.350 1.925 1 0.50		81	61 Por	41 Lints (Dis	tance <sup>21</sup>		2:351 1:925 2:5001 1:15 1:13 11 9 7 5 3 1	200 75 0 97 75 77 77 77 77 77 77	ofile Numb	ers				

Figure 4-32 Y Component of Magnetic Field at the Specified Observation Surface.



Figure 4-33 Dialog Box that Requires User Confirmation to Proceed with the Plots.

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ance	1	0.000000	1.0539	952	2.0843	71	3.069047	0	3.988277	4.825788	5.569329	6.210901	6.746666	7.176586	
tista	2	0.000000	1.2273	20	2.4249	25	3.564921	4	1.622858	5.578941	6.418777	7.133587	7.719973	8.179317	
8	3	0.000000	1.4362	:04	2.8345	26	4.159639	5	5.380997	6.474468	7.423232	8.217942	8.856230	9.341747	
nio	4	0.000000	1.6897	708	3.3306	11	4.877540	6	5.292073	7.544734	8.616068	9.496625	10.186036	10.691486	_
<b>P</b>	5	0.000000	1.9998	888	3.9361	45	5.750405	1	7.393997	8.830908	10.039012	11.009676	11.746087	12.260844	×
5								-	_						2
Electric Field Magnitude (V/m)															

Figure 4-34 X Component of Electric Field at the Specified Observation Surface.