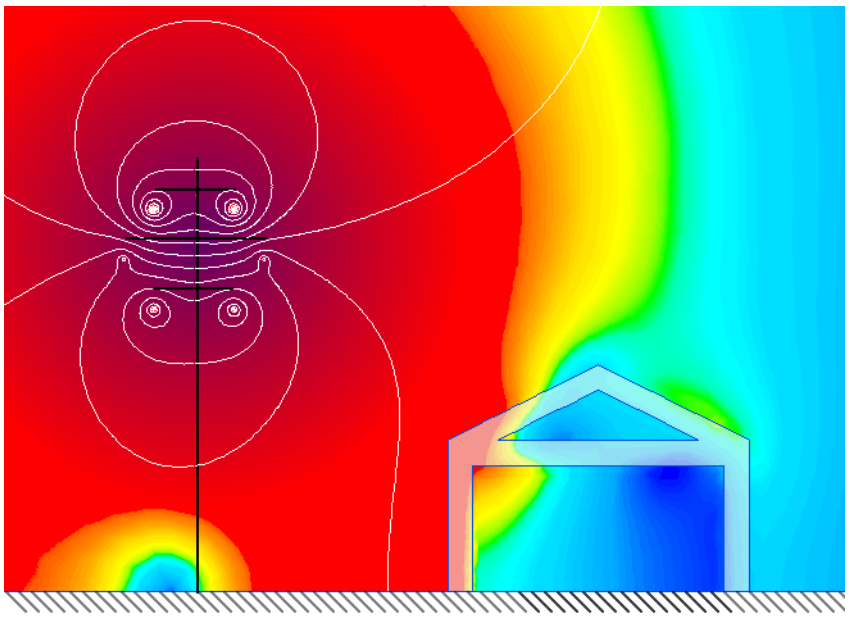
EMC analysis with QuickField

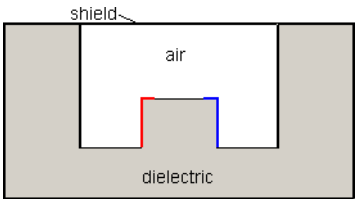
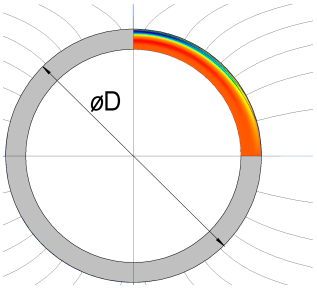
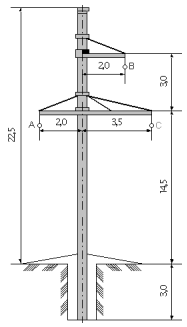
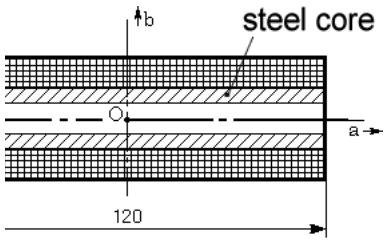
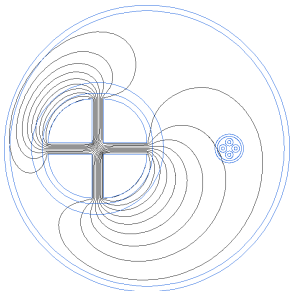
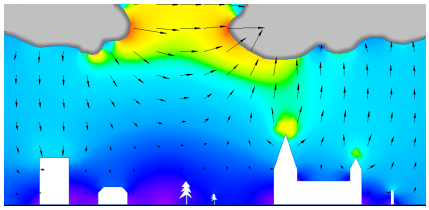


QuickField™ is a very efficient Finite Element Analysis package for electromagnetic, thermal, and stress design simulation with coupled multi-field analysis.

QuickField requires no training – you may start using it as soon as it is installed on your computer, without knowing the mathematical algorithms used and details of their implementation.

Here are some examples related to EMC analysis. You can download simulation files from our website:
QuickField.com > *Applications* > *Industrial* > *EMC analysis*

www.quickfield.com/app_emc.htm

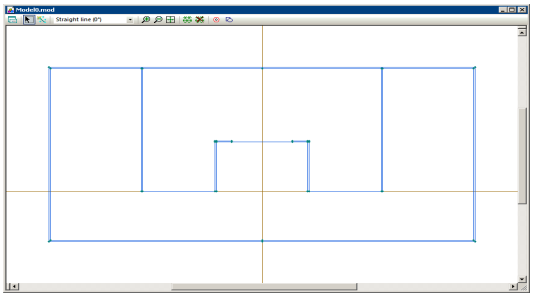
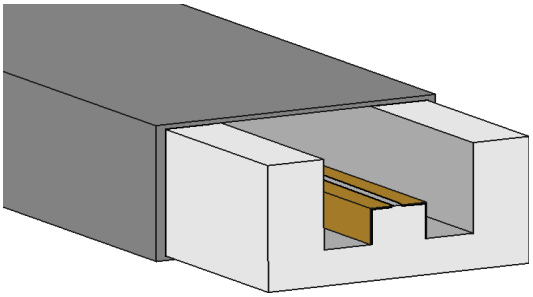
		
Attenuation constant Analysis type: *AC magnetic, Electrostatic*. Results: current and voltage as functions of time, impedance.	**Electromagnetic shielding** Analysis type: *DC magnetic, AC magnetic*. Results: magnetic field strength, shielding ratio.	**Line-to-line short circuit** Analysis type: *Transient magnetic*. Results: magnetic field strength (as a function of time), current (as a function of time).
		
Coil with ferromagnetic core Analysis type: *Transient magnetic*. Results: magnetic field strength, harmonic analysis.	**Cable duct** Analysis type: *Electrostatic*. Results: electric field strength, capacitance matrix.	**Storm** Analysis type: *Electrostatic*. Results: electric field strength.

Attenuation constant

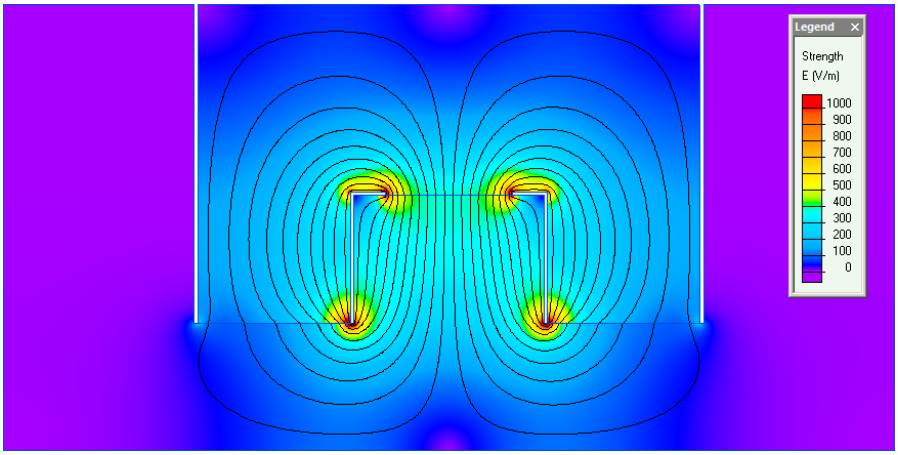
www.quickfield.com/advanced/microstrip_transmission_line.htm

The shielded transmission line is considered. The line consists of two copper conductors that are rested on the polyethylene substrate. The whole structure with some air around is shielded by a screen.

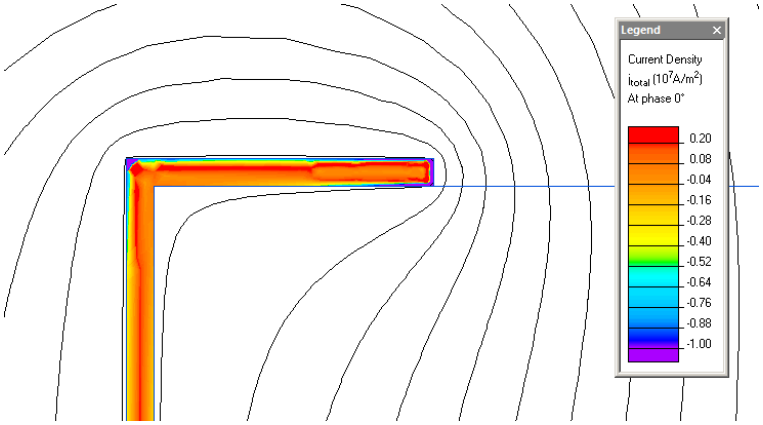
Attenuation constant of the shielded microstrip-like transmission line is obtained using the **Electrostatic** and **AC magnetic** analysis modules of QuickField.

QuickField model	Sketch
	

Electric field strength in the microstrip line.



Eddy currents in the conductors.

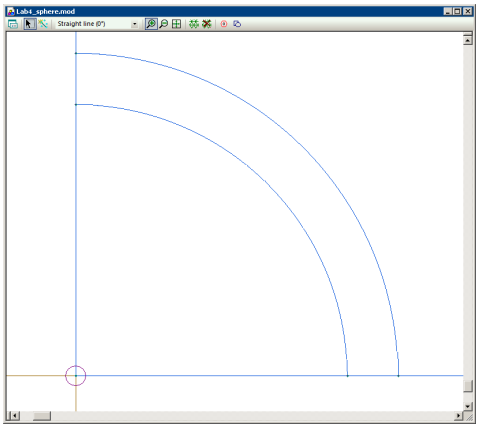
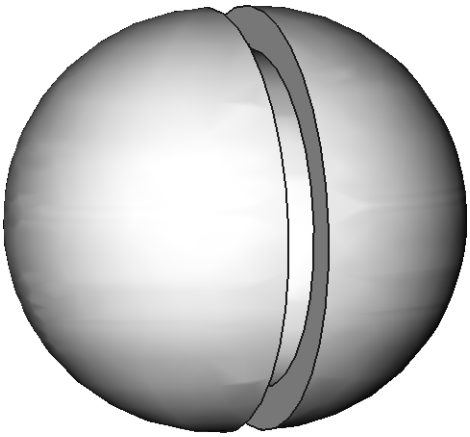


Attenuation of the line: $\alpha = 869 \cdot 0.5R/Z_0$ [dB/100m].

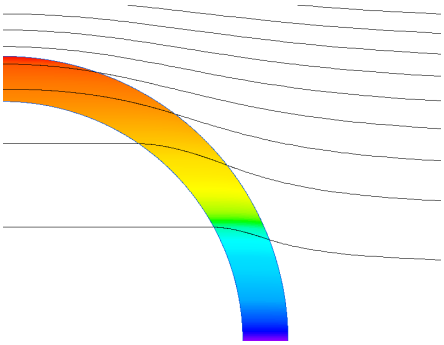
Electromagnetic shielding

www.quickfield.com/advanced/toe_lab4.htm

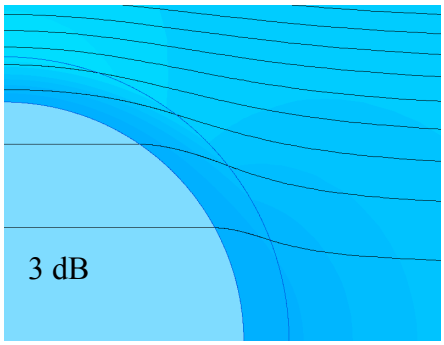
Spherical shield made of steel and copper is analyzed. The shield consists of two semi-spherical parts. **DC** and **AC magnetic** modules of QuickField are used for obtaining the levels of AC and DC magnetic fields reduction inside the shield.

QuickField model	Sketch
 Due to the device symmetry only one quarter of the device is presented in the model.	

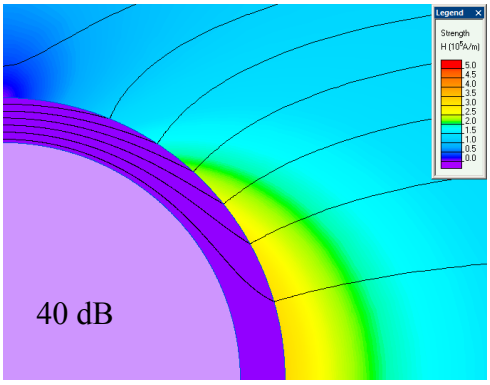
Eddy currents
in the copper shield, f=50 Hz



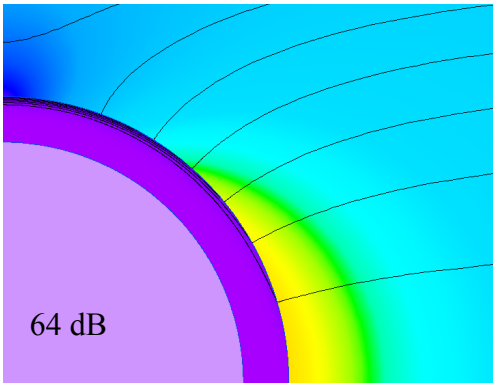
Magnetic field strength
in the copper shield, f=50 Hz



Magnetic field strength
in the steel shield, DC.



Magnetic field strength
in the steel shield, f=50 Hz

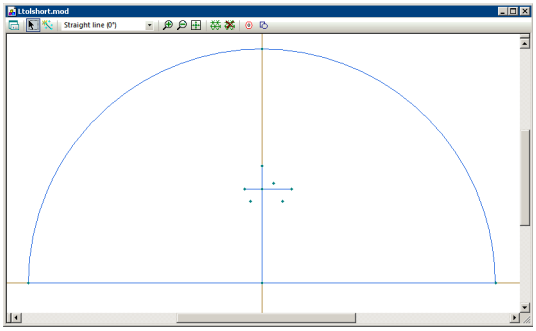


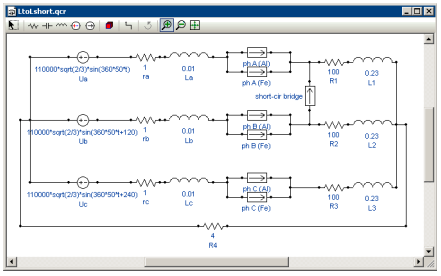
Line-to-line short circuit

www.quickfield.com/advanced/line_to_line_short.htm

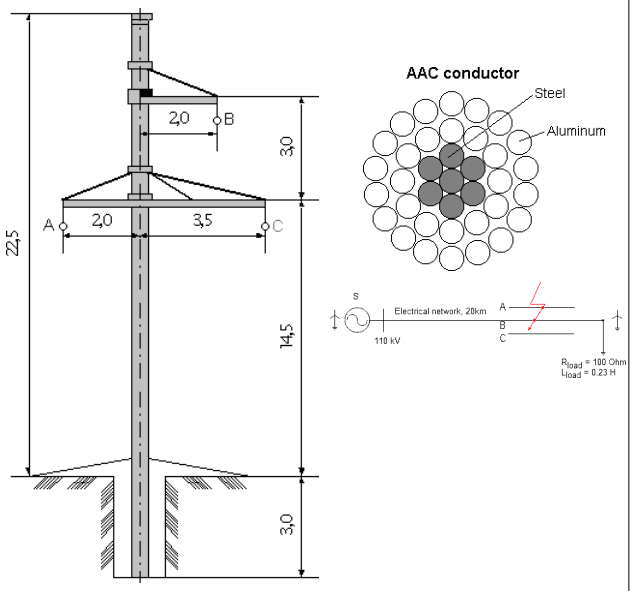
Line-to-line short circuit is one of the most widespread damages of the transmission lines in electrical networks. This model shows how to simulate the line-to-line short circuit and resulting electromagnetic fields using the **Transient magnetic** analysis module of QuickField.

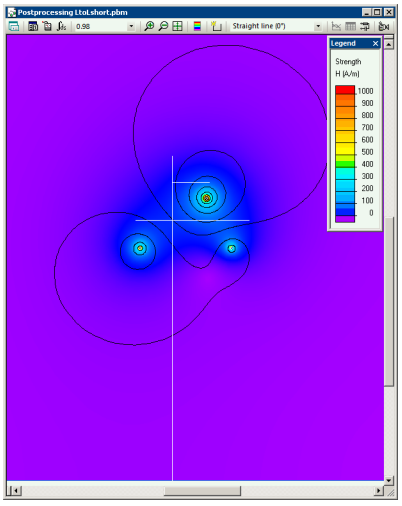
QuickField model



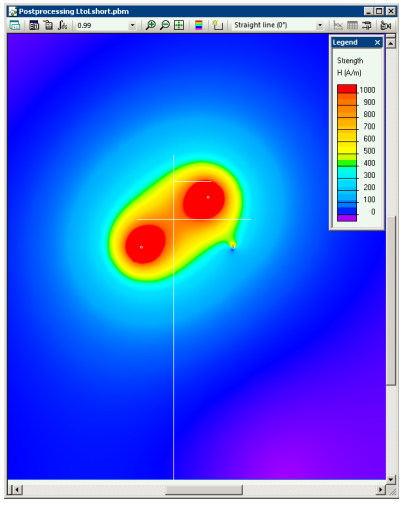


Sketch

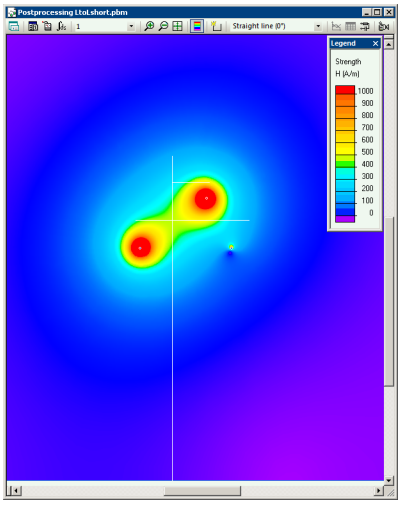




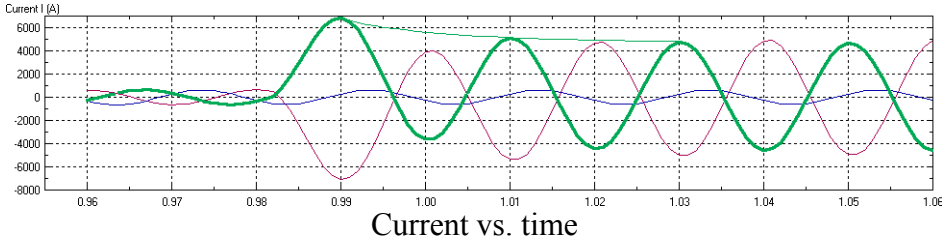
t = 0.98 s



t = 0.99 s



t = 1.00 s

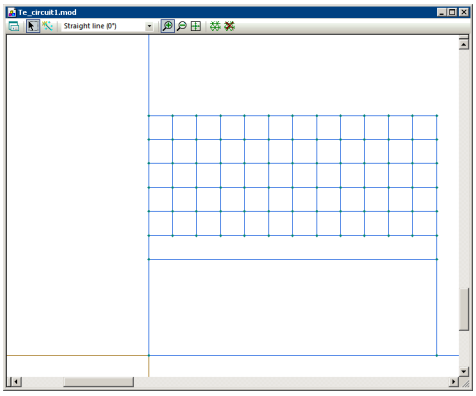
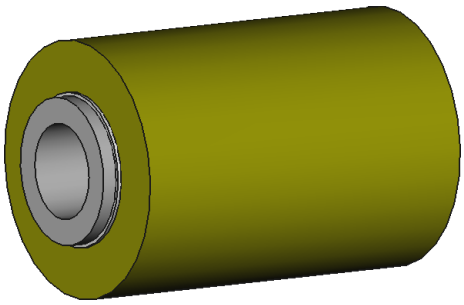


Current vs. time

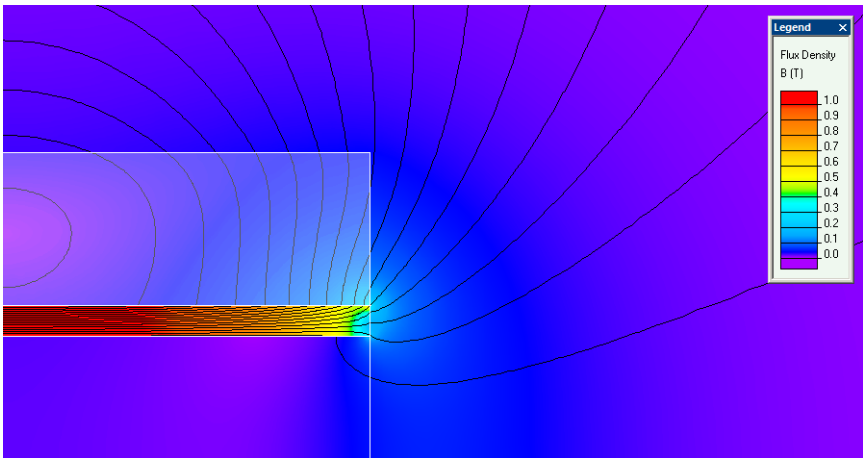
Coil with ferromagnetic core

www.quickfield.com/advanced/tecircuit1.htm

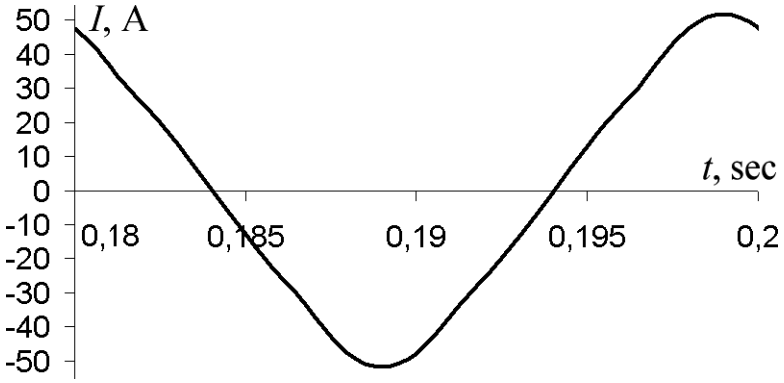
Non-linear ferromagnetic core causes the signal distortion. Fourier analysis of the output signal should be performed. **Transient magnetic** simulation with QuickField helps to find required values.

QuickField model	Sketch
 Due to the device symmetry only one quarter of the device is presented in the model. Axis of rotation is a horizontal one.	

Magnetic flux density of the coil.



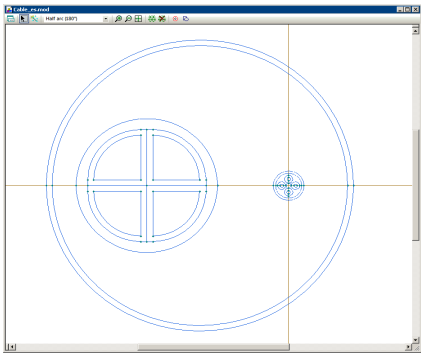
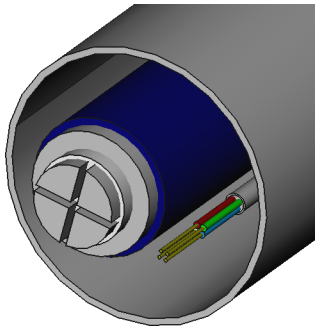
The current in the winding is: $I(t) = 48.1 \cdot \sin(wt + 108°) + 3.2 \cdot \sin(3wt + 147°) + 1 \cdot \sin(5wt + 177°)$



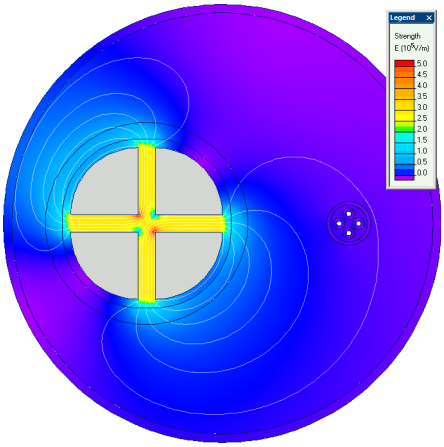
Signal cable

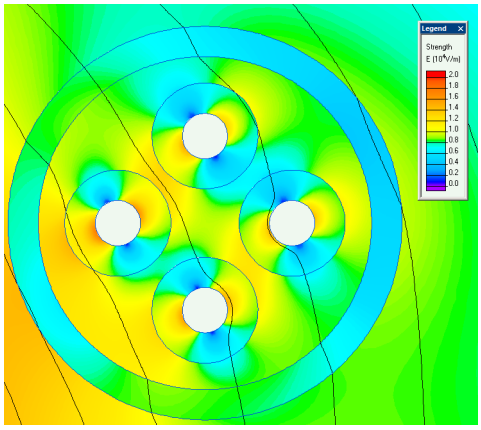
www.quickfield.com/advanced/signal_cable.htm

Power and signal cable are buried in a common duct. QuickField **Electrostatic** simulation helps to analyze the electric fields distribution and find the mutual capacitance.

QuickField model	Sketch
	

Electric field strength distribution.





Full capacitance matrix.

CMatrix - Capacitance Matrix Calcualtor

Choose Problem: cable_es.pbm

Conductor	Info
a	
b	
c	
0	
s4	
shield	Grounded
s1	

Close | Calculate | Help

Electrostatic induction coefficients

	0	1	2	3	4	5
0	2.2466e-010	-1.0156e-010	-5.2571e-013	-1.6873e-012	-4.1684e-013	-1.0033e-012
1	-1.0156e-010	2.3071e-010	-8.9571e-015	-2.7589e-014	-1.2348e-014	-2.5065e-014
2	-5.2571e-013	-8.9571e-015	6.1198e-011	-2.5341e-011	-2.5232e-011	-4.9724e-012
3	-1.6873e-012	-2.7589e-014	-2.5341e-011	6.602e-011	-8.3272e-012	-2.5354e-011
4	-4.1684e-013	-1.2348e-014	-2.5232e-011	-8.3272e-012	6.637e-011	-2.5215e-011
5	-1.0033e-012	-2.5065e-014	-4.9724e-012	-2.5354e-011	-2.5215e-011	6.1187e-011

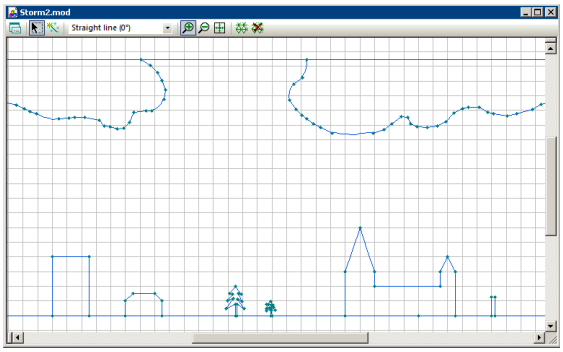
Self and mutual partial capacitances

	0	1	2	3	4	5
0	1.1946e-010	1.0156e-010	5.2571e-013	1.6873e-012	4.1684e-013	1.0033e-012
1	1.0156e-010	1.2907e-010	8.9571e-015	2.7589e-014	1.2348e-014	2.5065e-014
2	5.2571e-013	8.9571e-015	5.1179e-012	2.5341e-011	2.5232e-011	4.9724e-012
3	1.6873e-012	2.7589e-014	2.5341e-011	5.2826e-012	8.3272e-012	2.5354e-011
4	4.1684e-013	1.2348e-014	2.5232e-011	8.3272e-012	7.1677e-012	2.5215e-011

Storm

www.quickfield.com/advanced/storm.htm

This **Electrostatic** simulation with QuickField presents the electric field stress distribution in case of storm.

QuickField model	Sketch
	

Electric field distribution near the rooftops during the electric storm.