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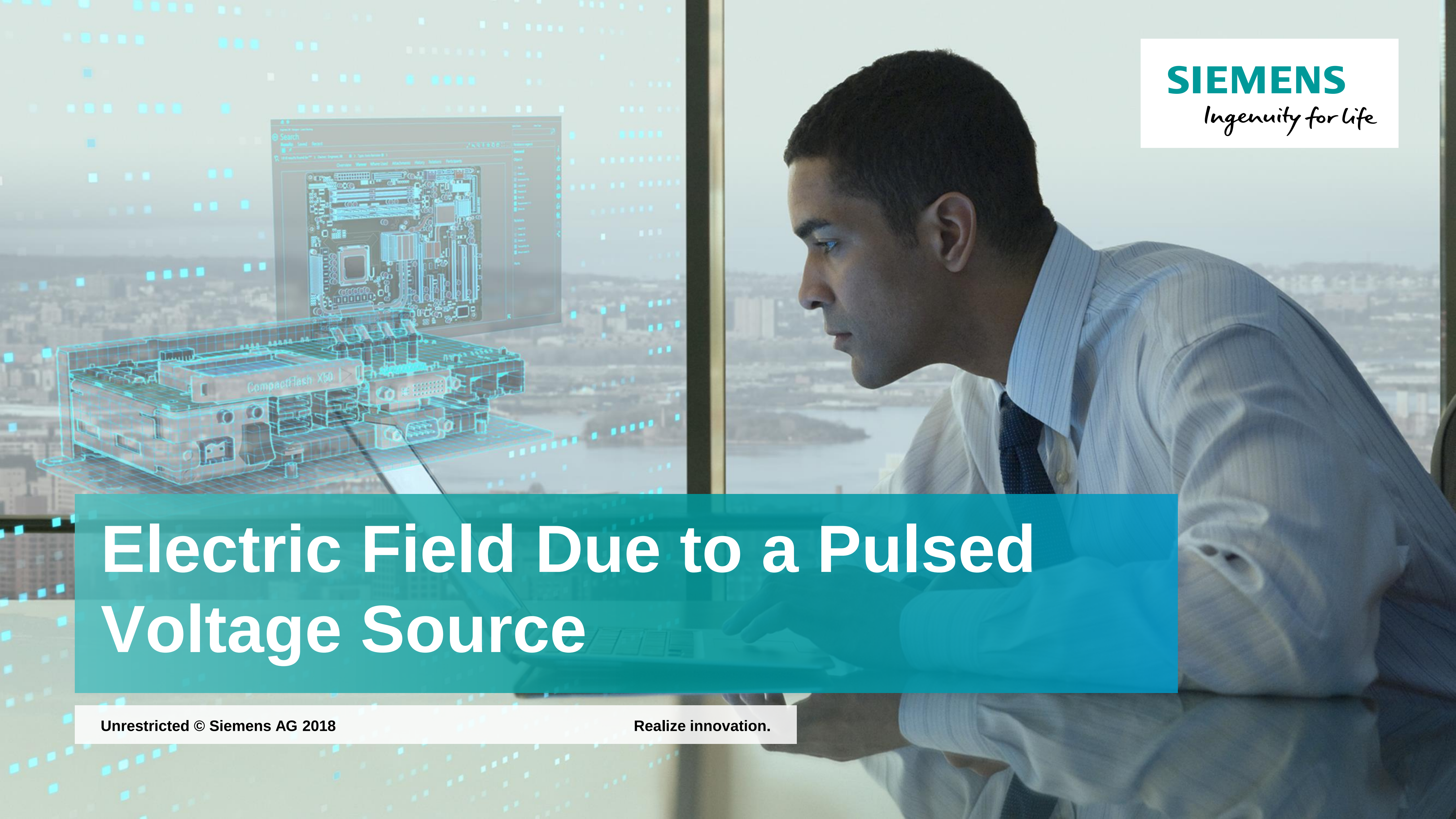

# Electric Field Due to a Pulsed Voltage Source



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# Electric Field Due to a Pulsed Voltage Source

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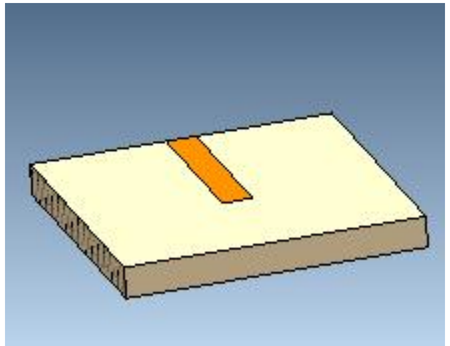
The 3D transient electric field simulation of a simple copper strip on a dielectric layer over a ground plane is described in this example. The analysis is in 3D since the copper strip is short and there is fringing of the electric field at the end of the strip.



The material chosen for the dielectric layer is slightly lossy, i.e., it has a small conductivity. The small conductivity is responsible for the conduction current that flows from the copper strip to the ground through the dielectric layer.

Since the conductive and capacitive effects in this device are both important, a time domain analysis is required.

# Pulse Voltage Waveform

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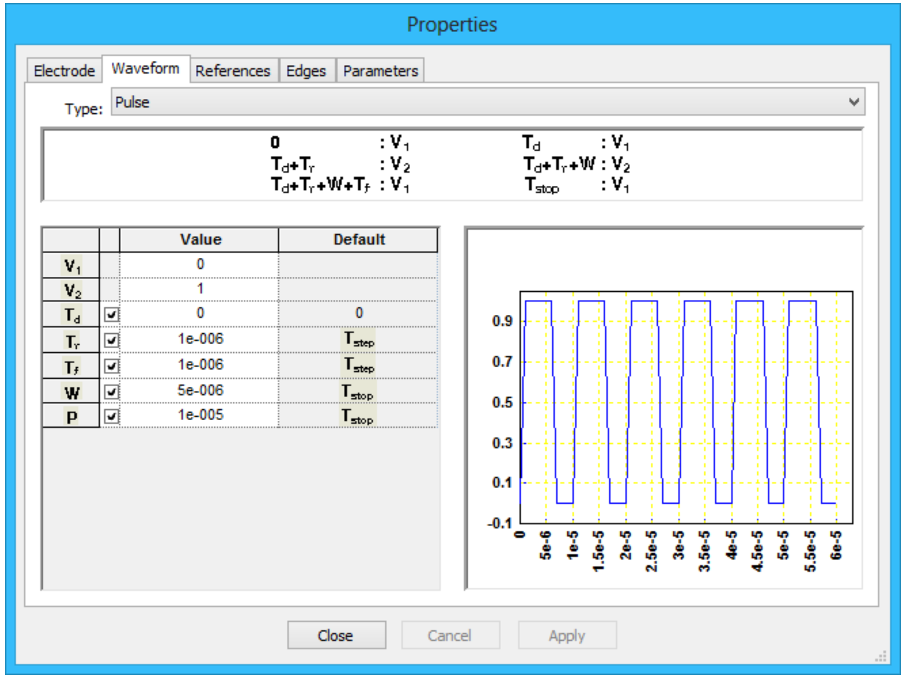
The pulse voltage waveform applied to the copper strip is shown in this figure. One of the reasons for performing an electric field transient simulation is because the voltage source is varying with time. For sinusoidal waveforms, it is possible to use a time-harmonic electric field solver, but for other types of waveforms, such as the one used in this example, a transient field simulation is more appropriate.

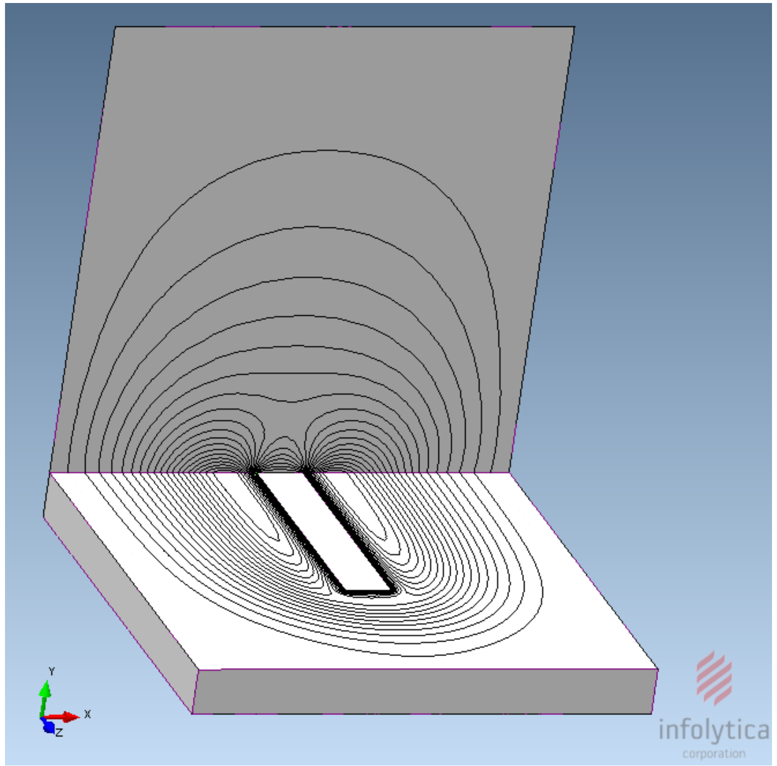


# Electric Fields

Once the transient simulation is complete, the user can view the electric field at any time instant. This figure shows the equipotential lines on the surfaces of the dielectric layer as well as one of the boundary faces at one time instant. As shown, the entire copper strip is at one potential.

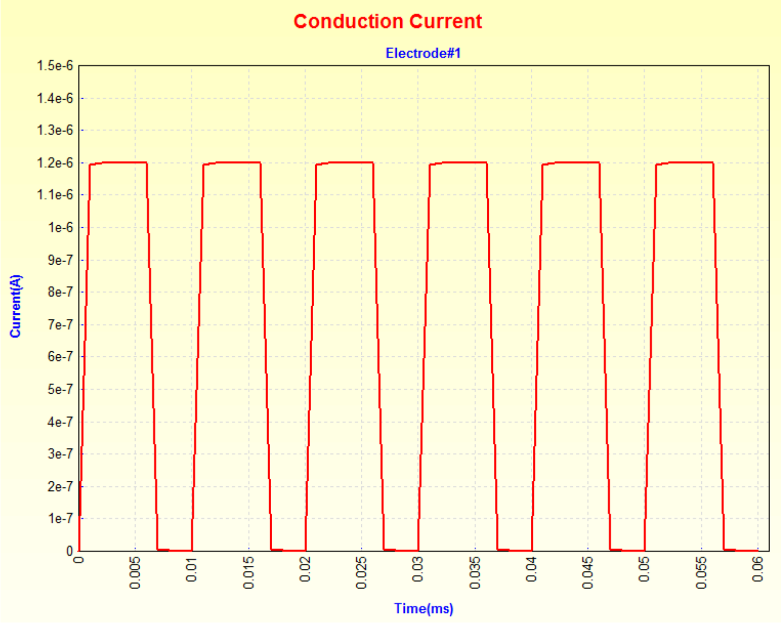
Other fields such as E, D, J and loss density can be viewed in the form of contours, shaded or arrow plots.

The fields can also be animated over time in order to examine their evolution starting from when the voltage source is switched on.



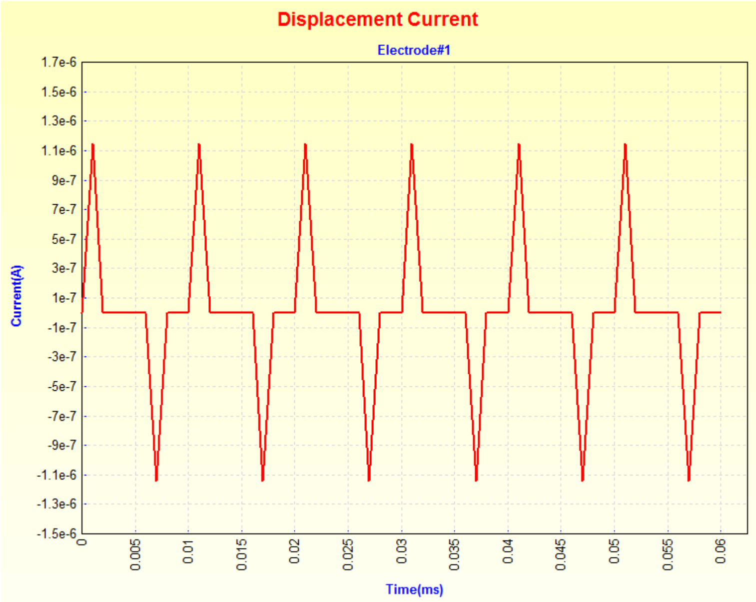
# Conduction Current

A number of useful global quantities are readily available once the simulation is complete. These are the stored electric energy, forces, charge, ohmic loss, conduction current and displacement current. This figure shows the conduction current that enters through the copper strip.



# Displacement Current

The displacement current as seen in this figure is another useful quantity. The displacement current is due to the time-varying nature of the voltage source. As can be seen, in this example, the displacement current is of the same order of magnitude as the conduction current, shown above.



# Total Current through the Copper Strip

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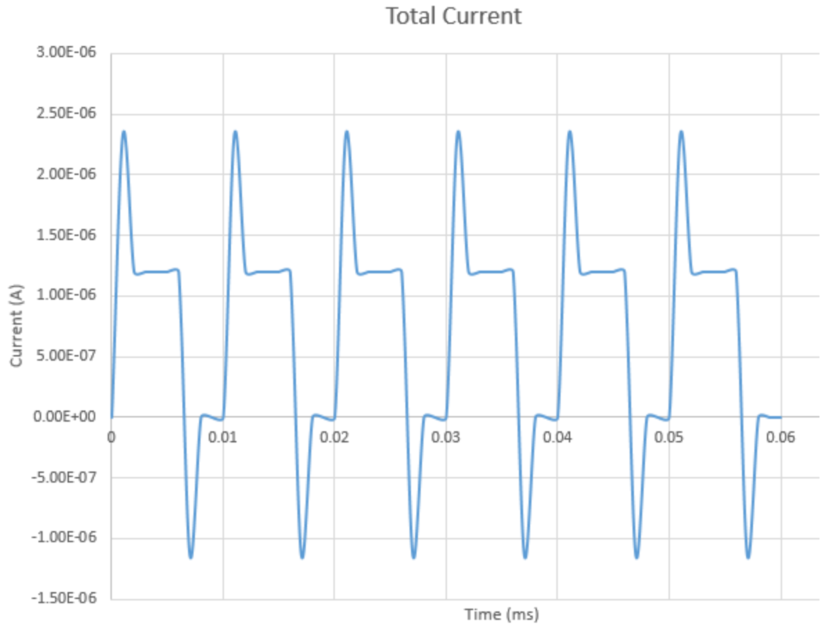
The total current through the copper strip is the sum of the conduction current and the displacement current.



# Current Density Plot

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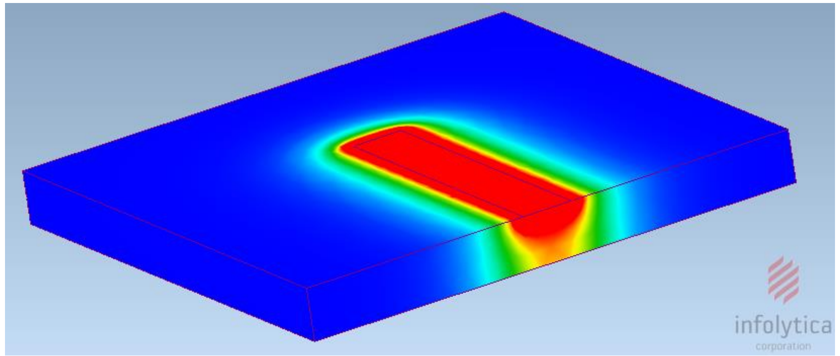
This figure shows the current density plot at a particular time instant. The lossy nature of the dielectric layer means that some current is traveling from the copper strip to ground through conduction.




The Ohmic loss density over the lossy dielectric layer can be viewed in order to determine where the loss is the largest. The total loss in the layer can be viewed in the form of a graph over time.