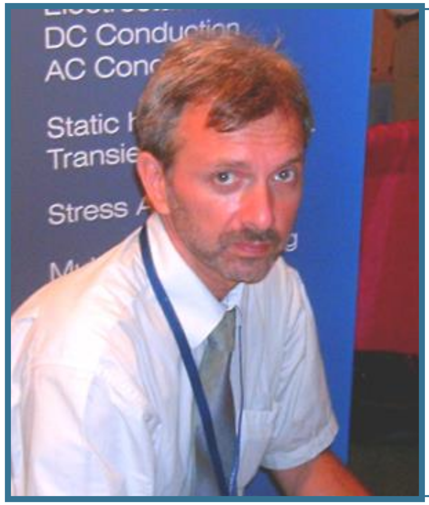
Alternating field simulation with QuickField



Vladimir Podnos

Director of Marketing and Support
Tera Analysis Ltd.

Alexander Lyubimtsev

Support Engineer
Tera Analysis Ltd.

https://quickfield.com/seminar/seminar_alternating.htm

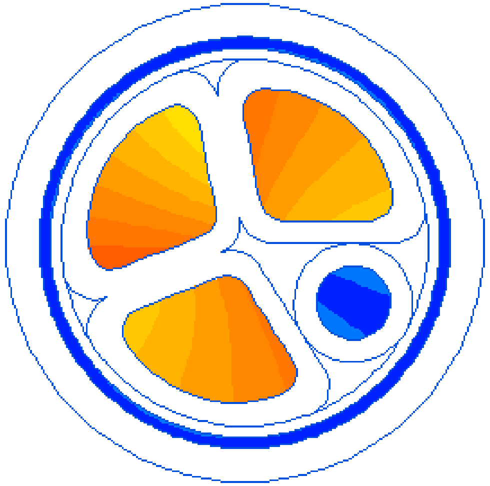
QuickField Analysis Options

Magnetic analysis suite	Magnetostatics
	AC Magnetics
	Transient Magnetic
Electric analysis suite	Electrostatics (2D,3D) and DC Conduction (2D,3D)
	AC Conduction
	Transient Electric field
Thermostructural analysis suite	Steady-State Heat transfer (2D,3D)
	Transient Heat transfer
	Stress analysis

https://quickfield.com/pack.htm

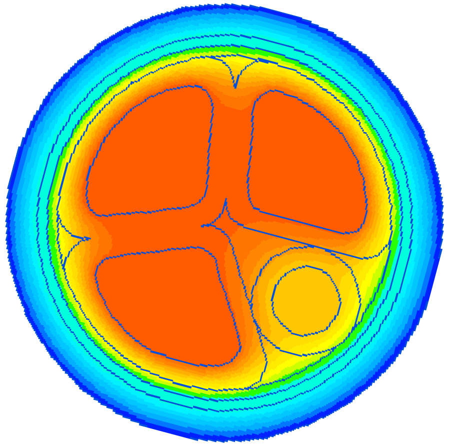
MultiPhysics (2D)

Electromagnetic fields



Losses

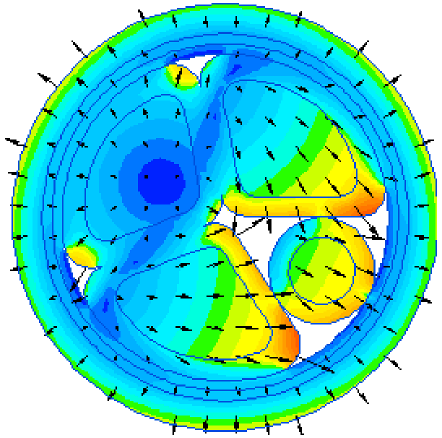
Temperature field



Temperature field import

Magnetic state import

Forces



Thermal Stresses

Stresses & Deformations

https://quickfield.com/coupling.htm

QuickField Analysis Options

Magnetic analysis suite	Magnetostatics
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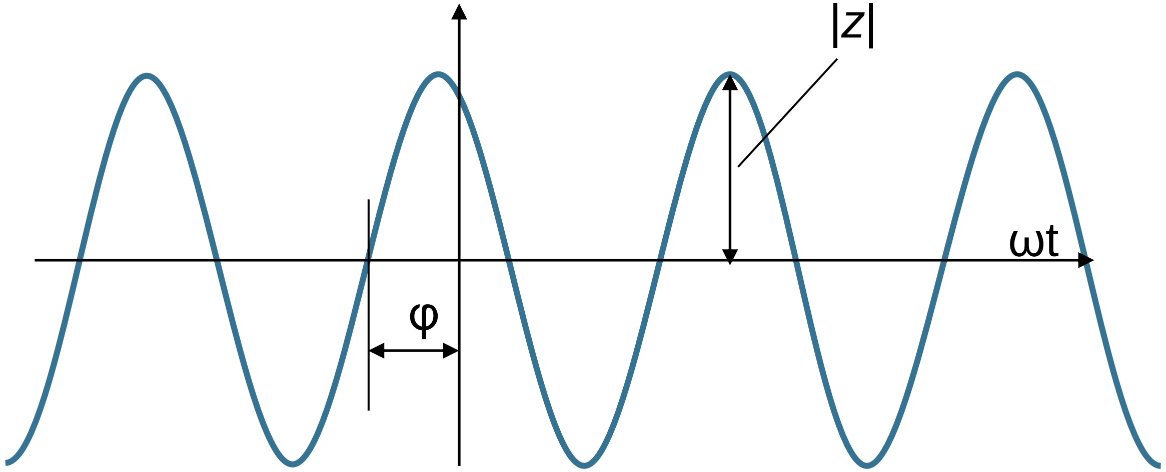
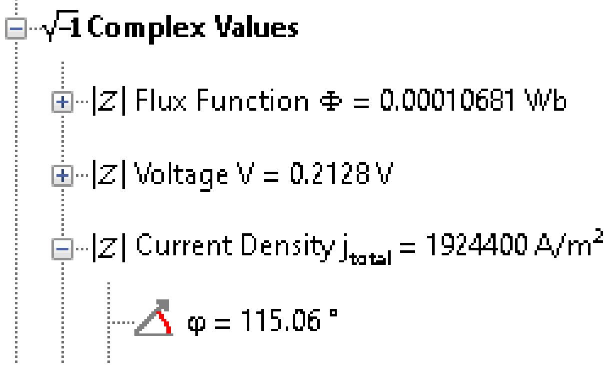
https://quickfield.com/pack.htm

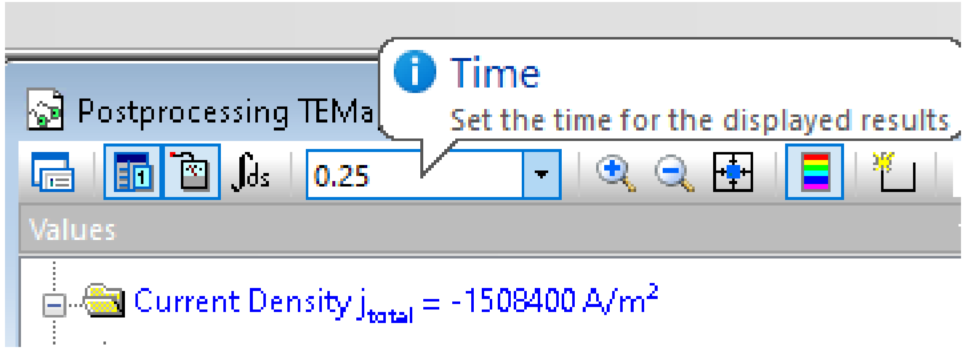
QuickField AC vs. Transient



Field components and electric currents are considered to be time-harmonic, vary with time as $z = z_0 \cdot \cos(\omega t + \varphi_z)$, and presented as complex values with real and imaginary parts.

Field sources and boundary conditions can be defined by time-dependent formulae (including time-harmonic), and the transient solution is obtained by time integration using time steps.





AC

Transient

QuickField AC vs. Transient

AC analysis:

Pros:
- Fast, because does not require time integration.

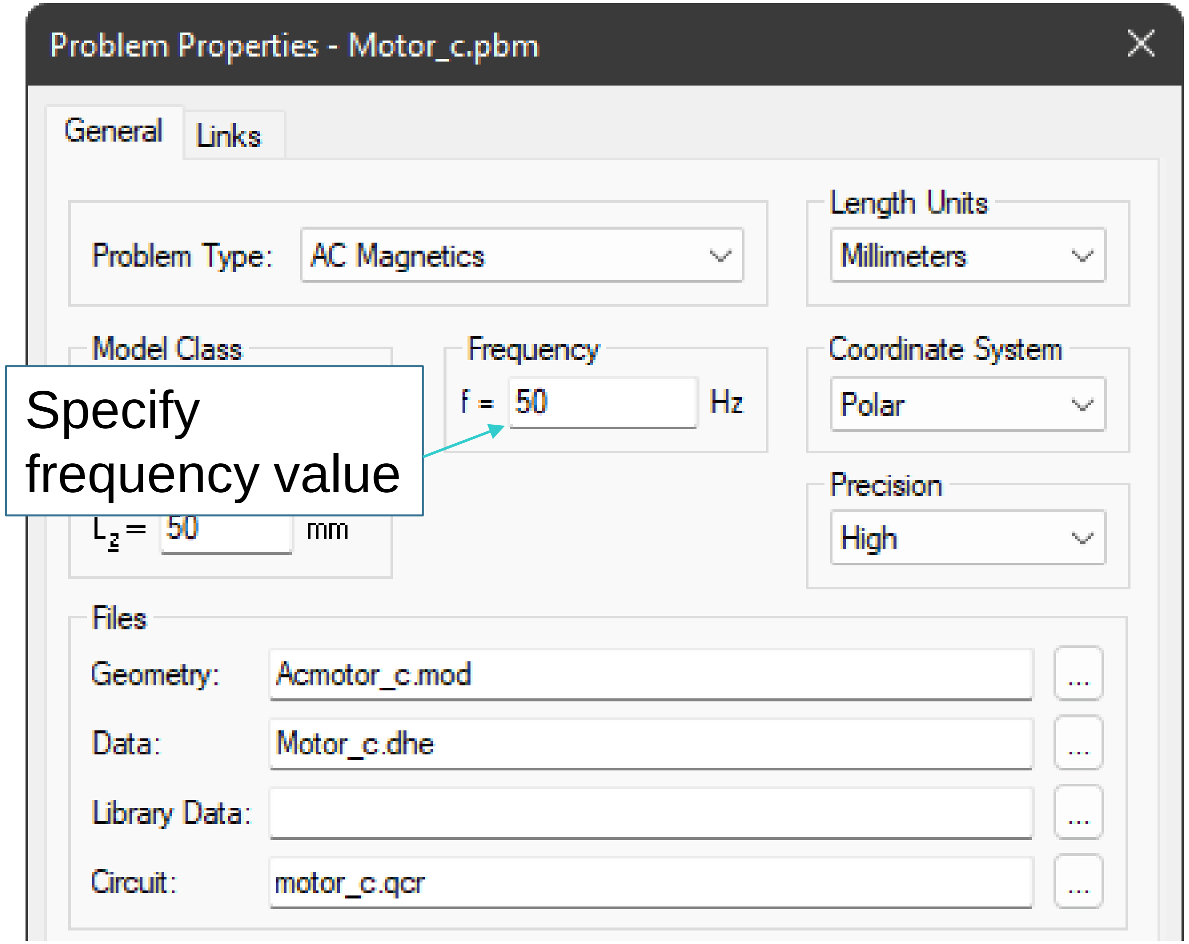
Cons:
- Does not allow analyzing non-linear effects

Transient analysis:

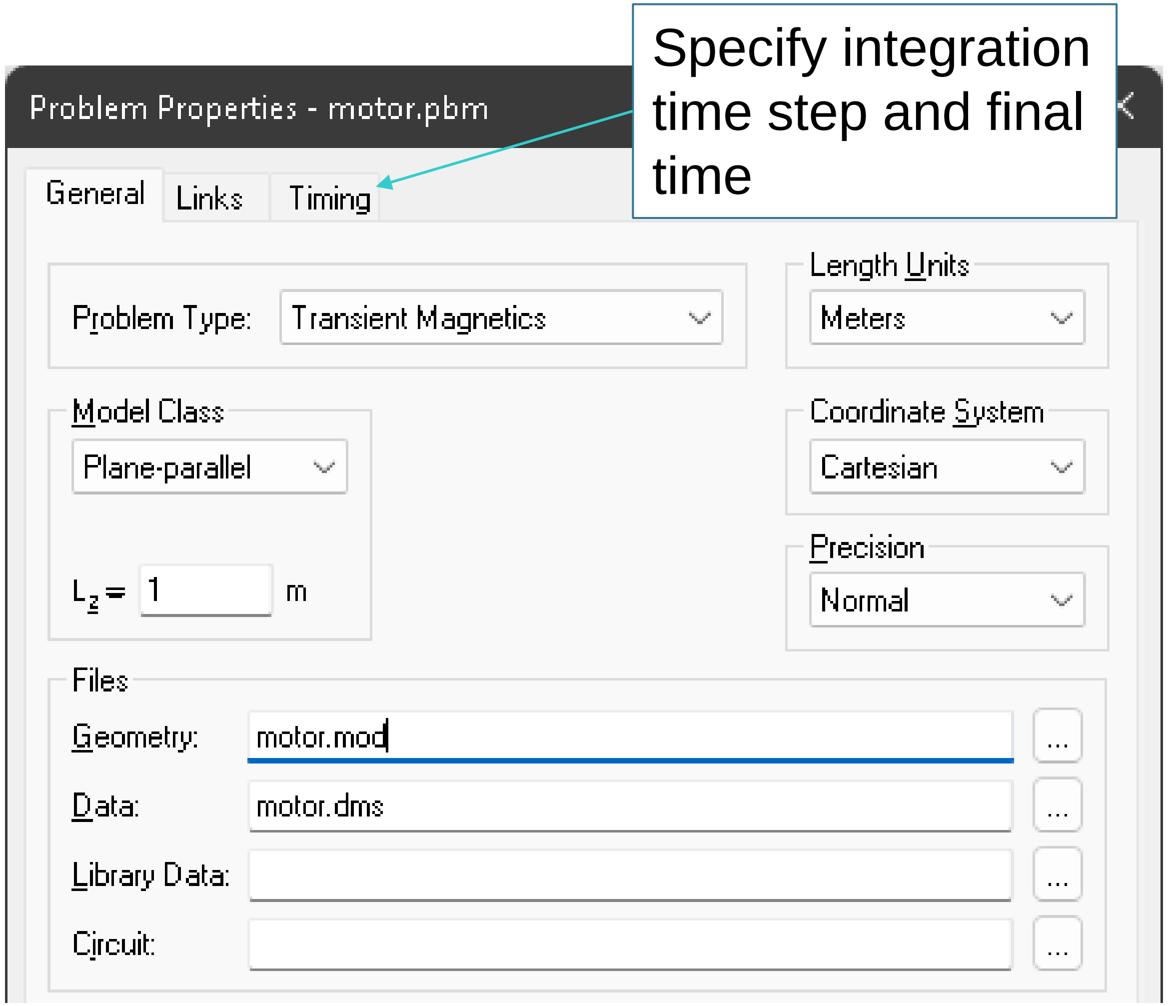
Pros:
- No limitations for non-linear material properties

Cons:
- Numerical integration in time domain requires solving of many problems for individual time steps.

QuickField AC vs. Transient

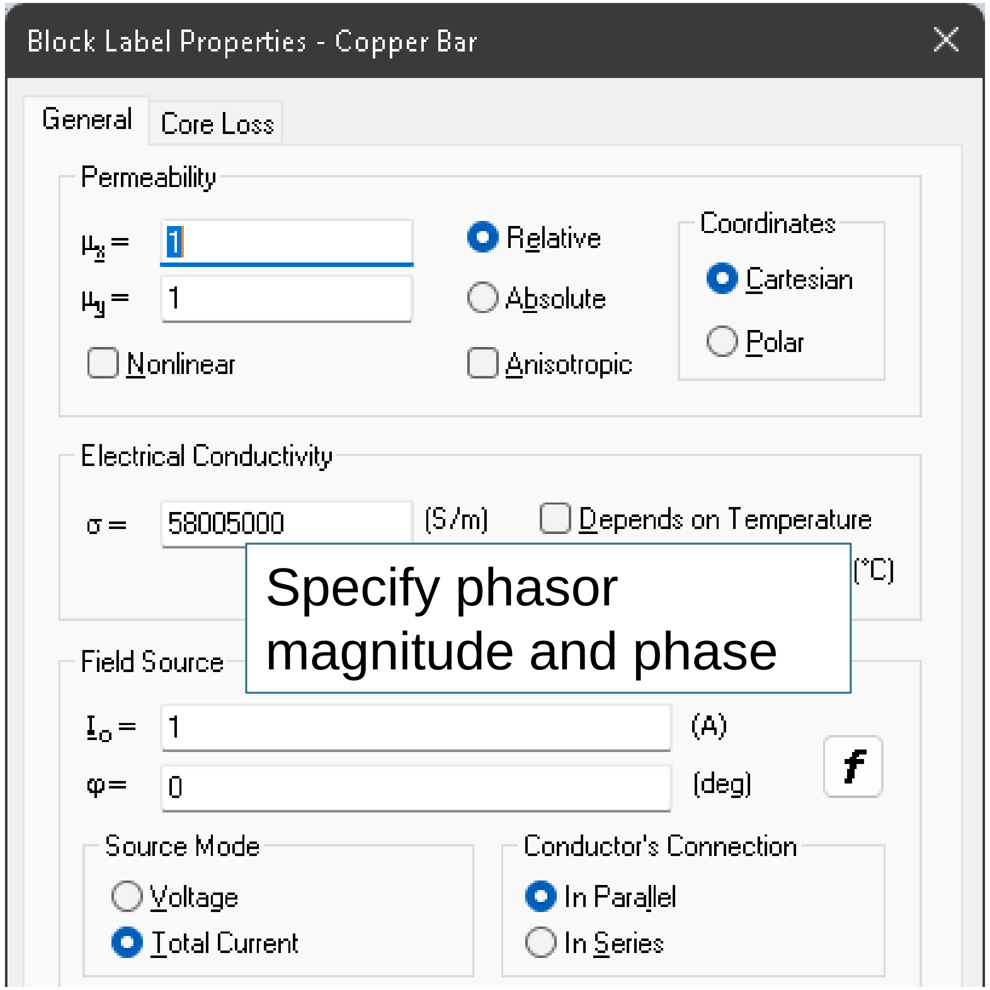


AC

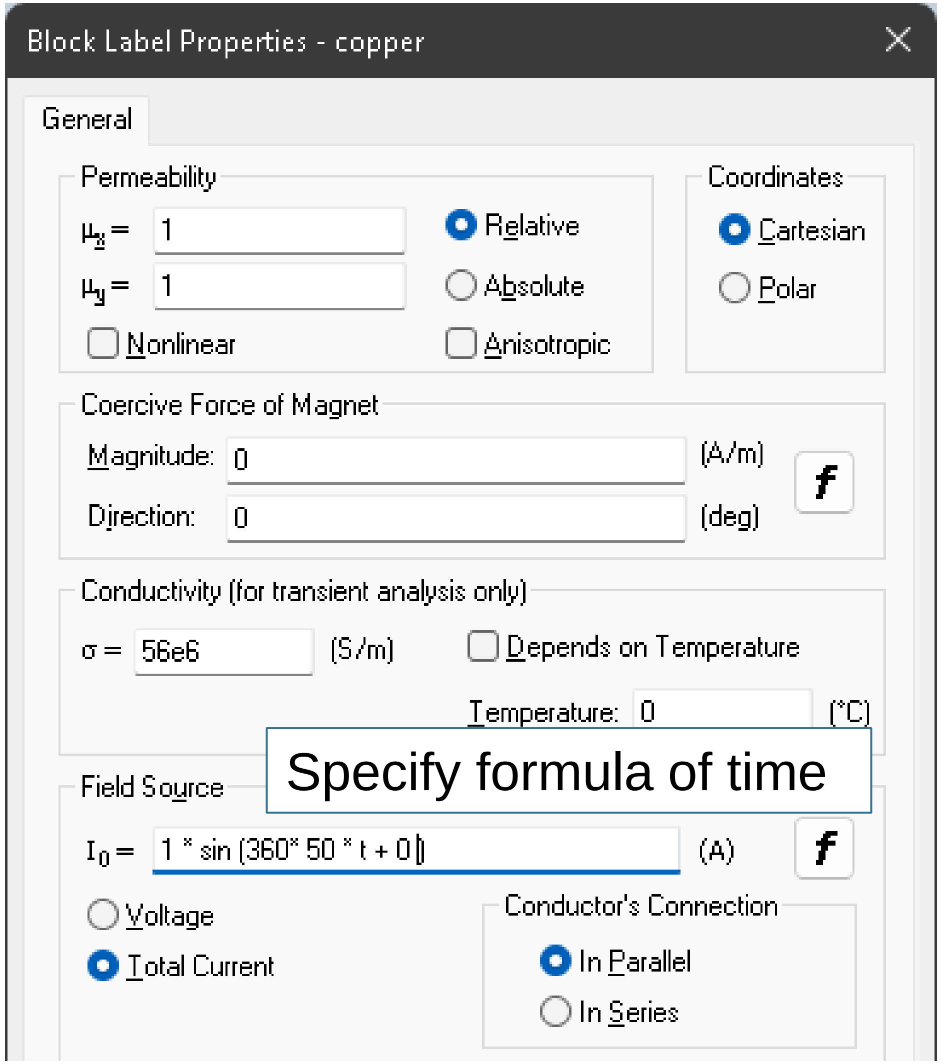


Transient

QuickField AC vs. Transient

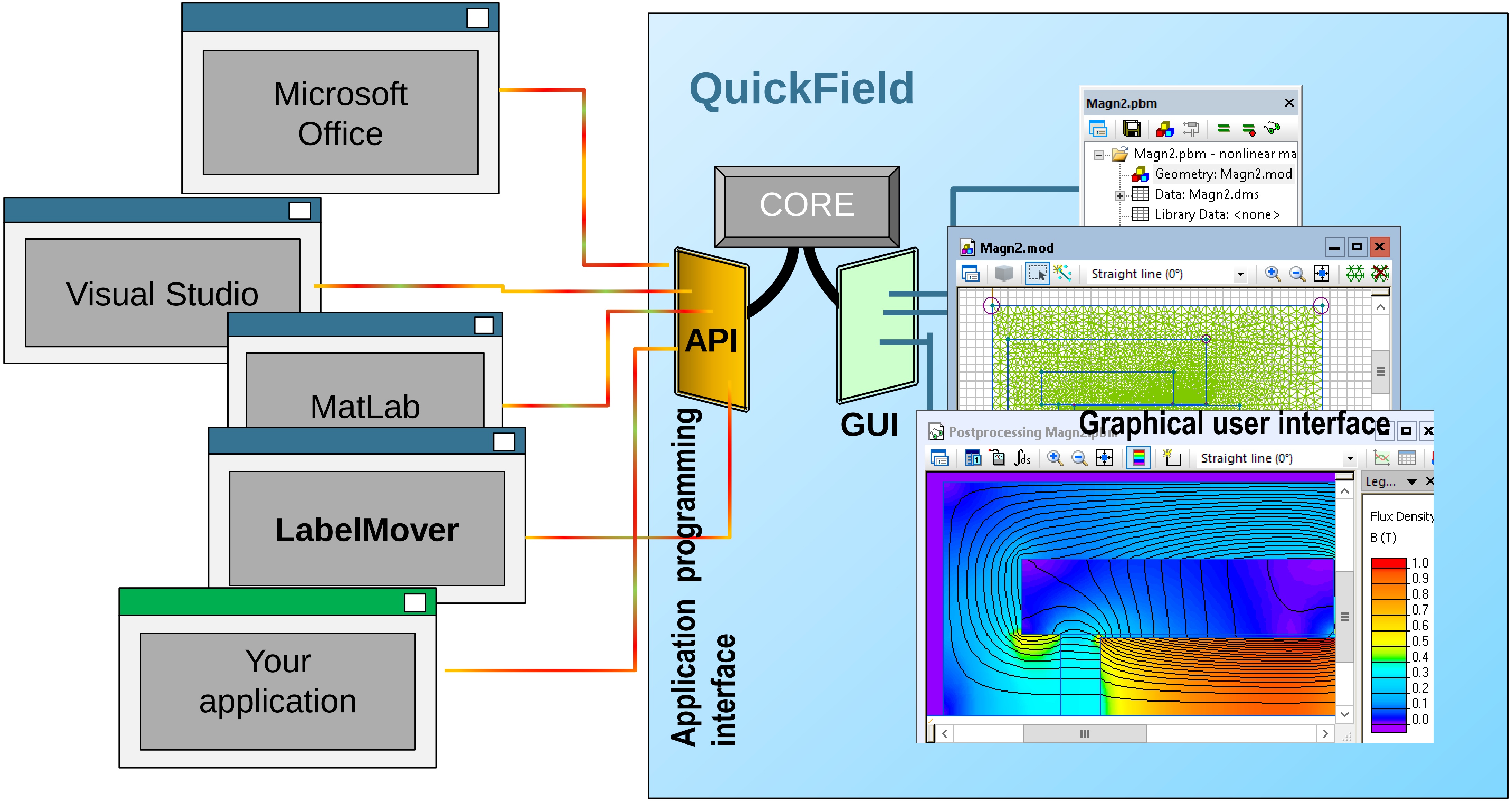


AC



Transient

QuickField API



https://quickfield.com/programming.htm

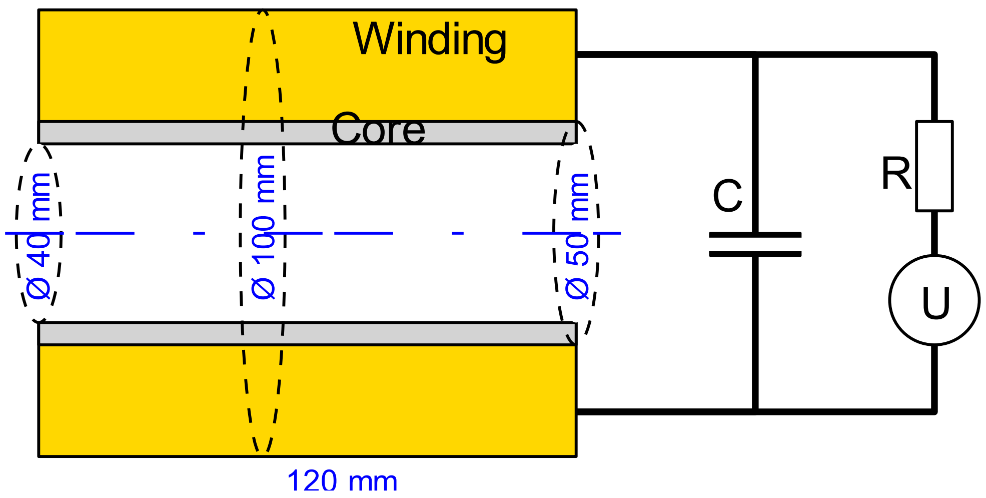
QuickField Difference

Field simulation software

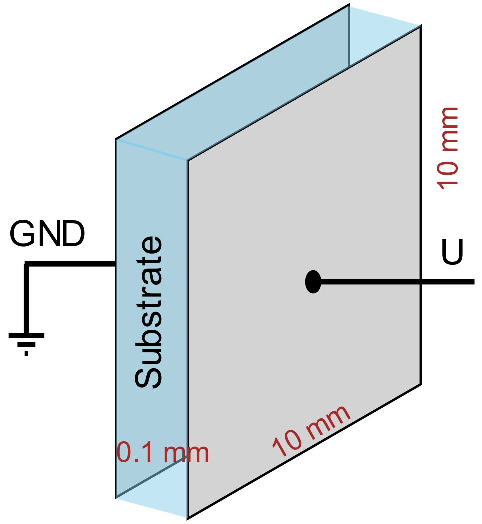
www.QuickField.com

No training required

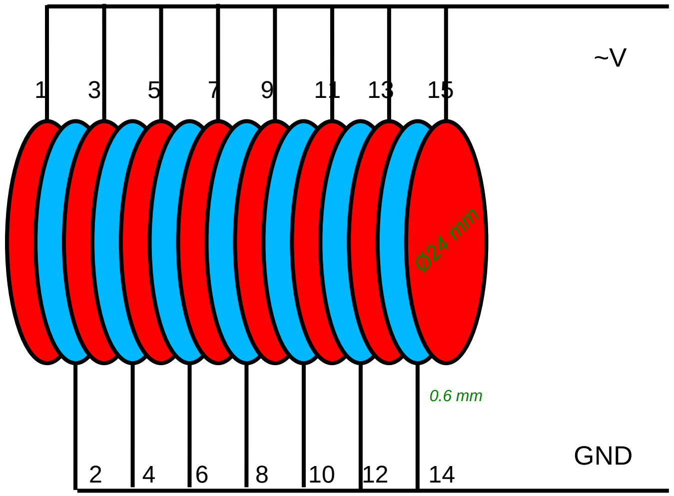
Alternating field simulation with QuickField



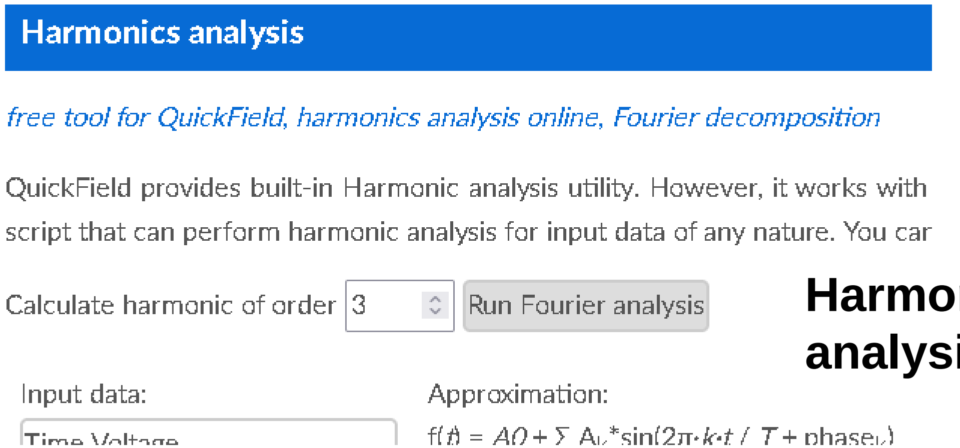
Coil with ferromagnetic core



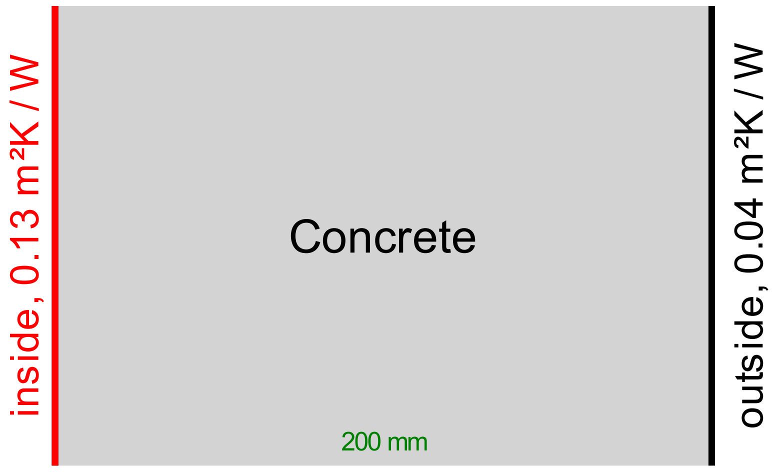
Plane capacitor



Nonlinear capacitor



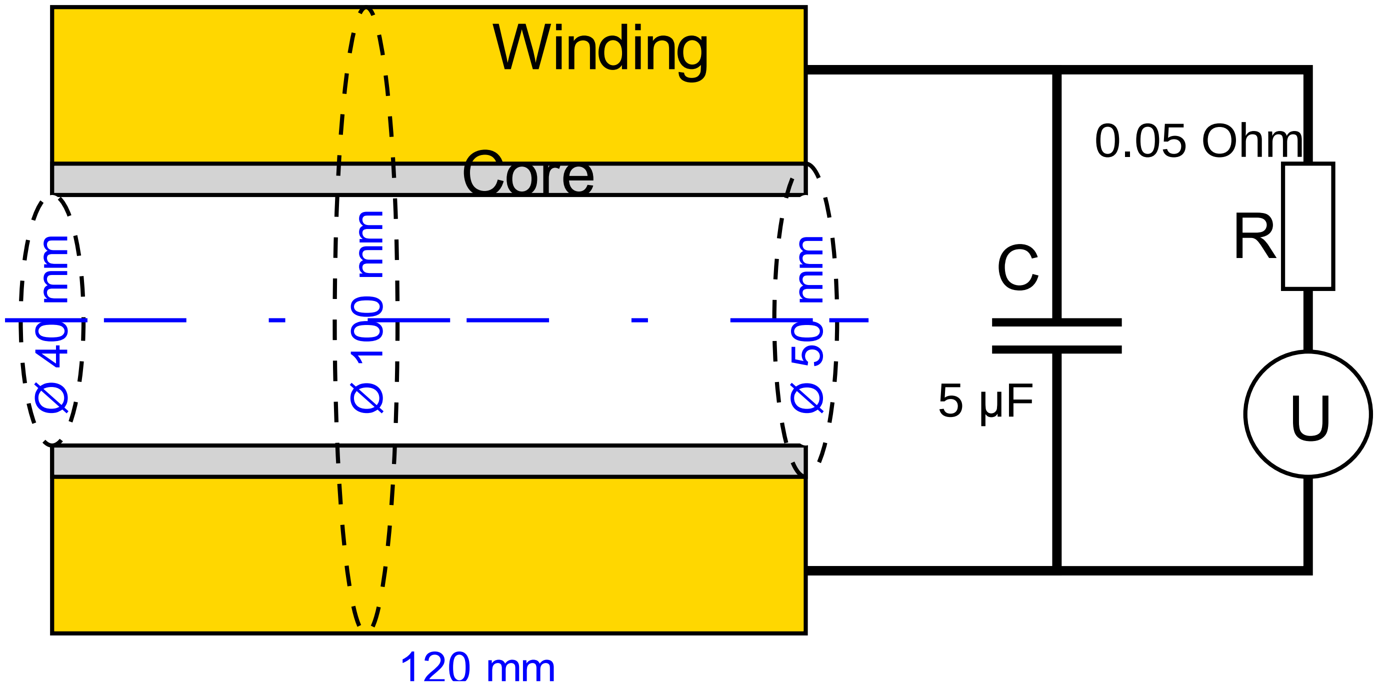
Harmonics analysis



Periodic thermal transmittance

https://quickfield.com/seminar/seminar_alternating.htm

Coil with ferromagnetic core

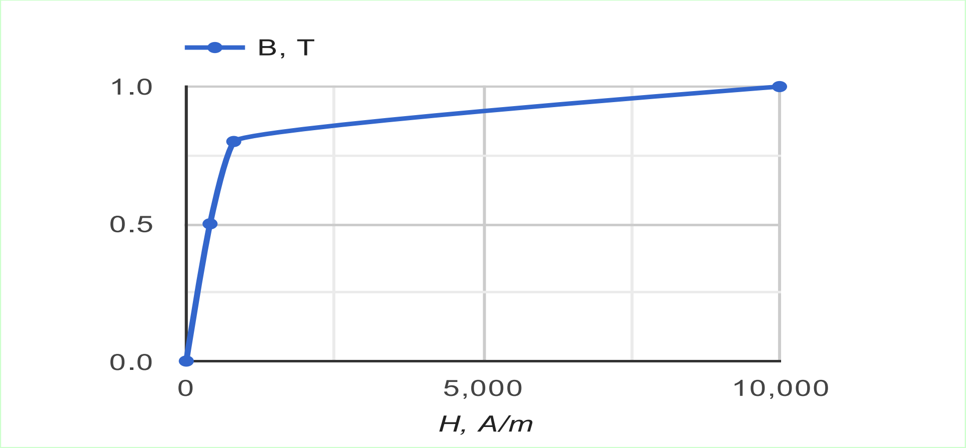


Task:

Determine current in the winding

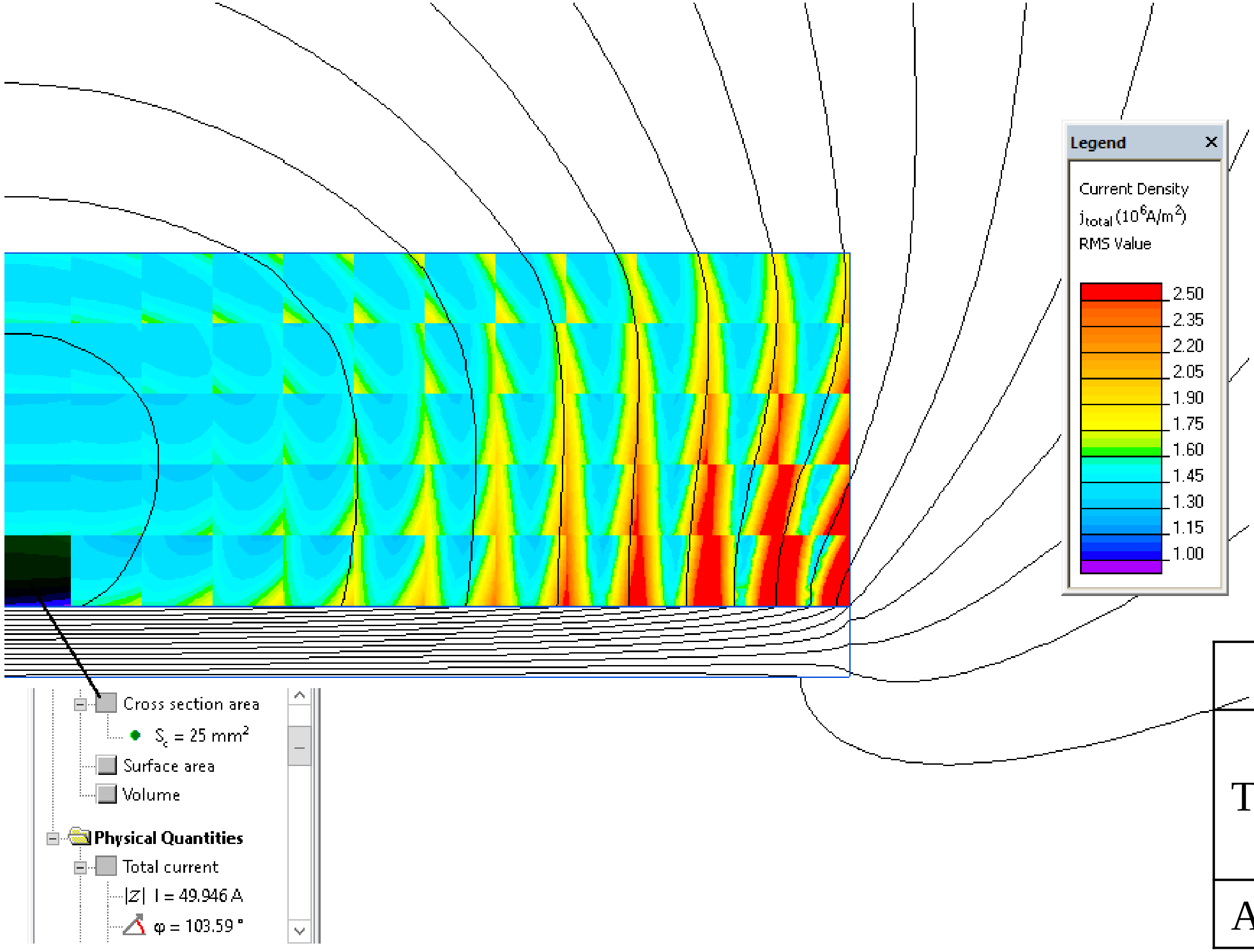
Problem specification:

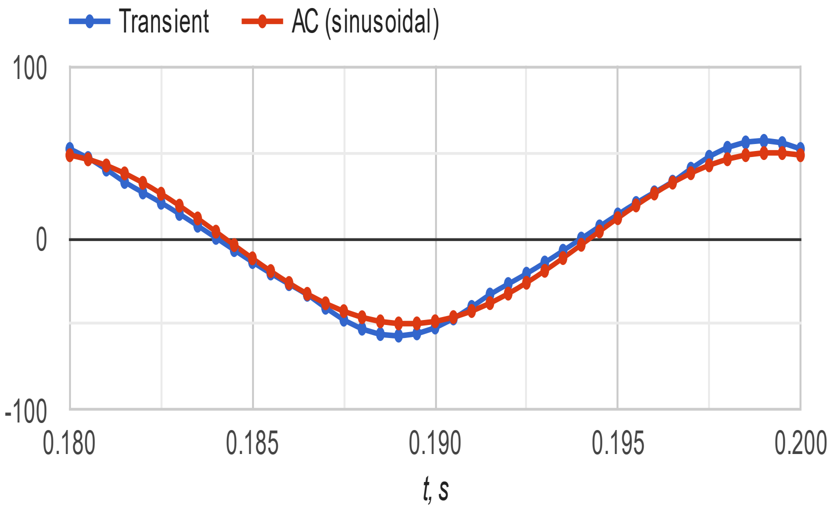
Number of turns *w* = 120
AC voltage value *U* = 13.33 V
Frequency *f* = 50 Hz.
Copper conductivity *g* = 56 MS/m;
Steel core conductivity *g* = 10 MS/m;
Magnetic permeability of the steel core:



https://quickfield.com/advanced/hmagn4.htm
https://quickfield.com/advanced/tecircuit1.htm
https://quickfield.com/harmonics_analysis_online.htm

Coil with ferromagnetic core



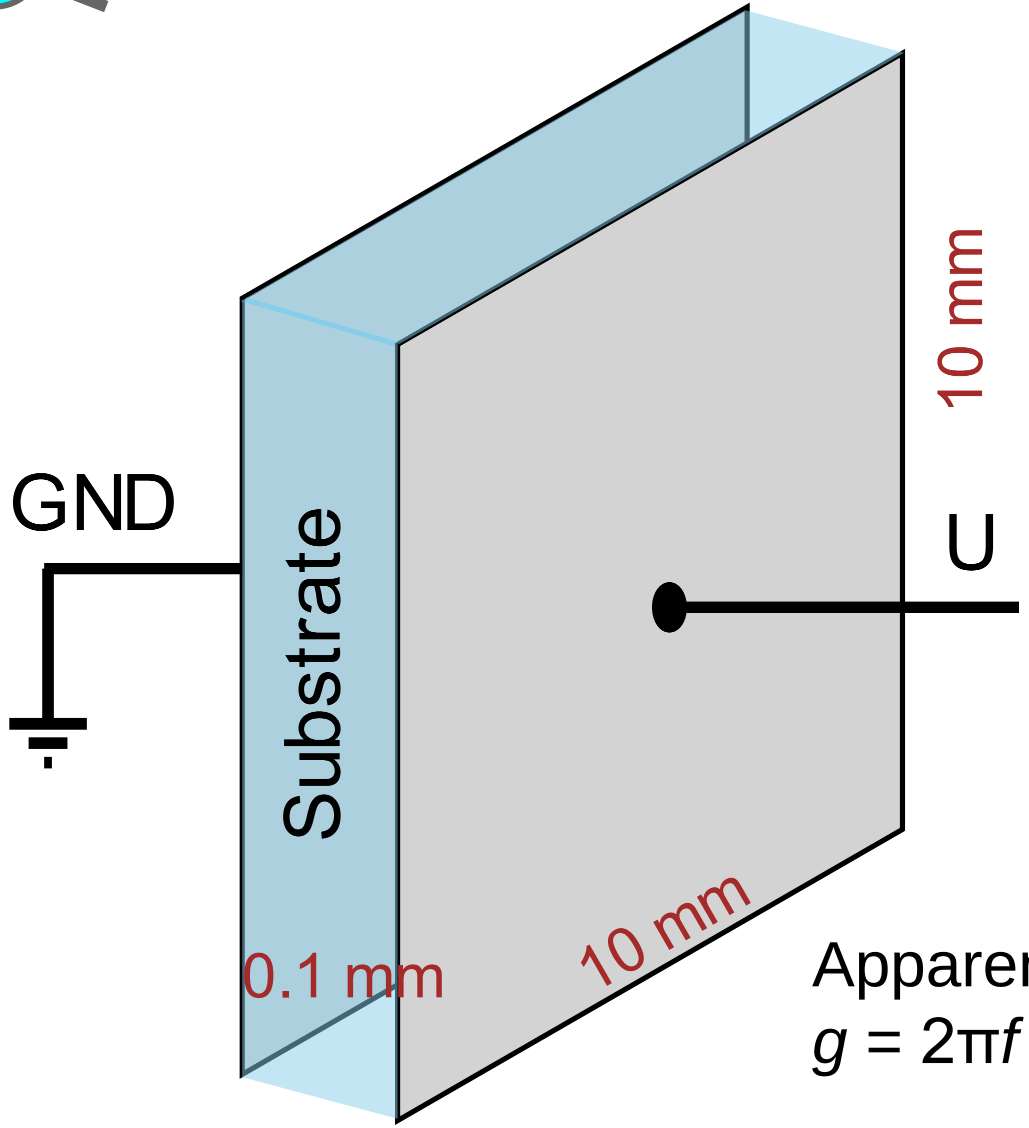


	Current wave form, A
Transient	$50.5\cdot\sin(wt + 108°) +$ $5.9\cdot\sin(3wt - 41°) +$ $3.9\cdot\sin(5wt + 148°)$
AC magnetics	$49.9\cdot\sin(wt + 104°)$

https://quickfield.com/advanced/hmagn4.htm
https://quickfield.com/advanced/tecircuit1.htm

https://quickfield.com/harmonics_analysis_online.htm

Plane capacitor



Apparent conductivity
$g = 2\pi f \cdot \varepsilon \cdot \varepsilon_0 \cdot \tan(\delta)$

Problem specification:

Relative permittivity of substrate ε = 10

Voltage U = 5 V, frequency f = 1 MHz

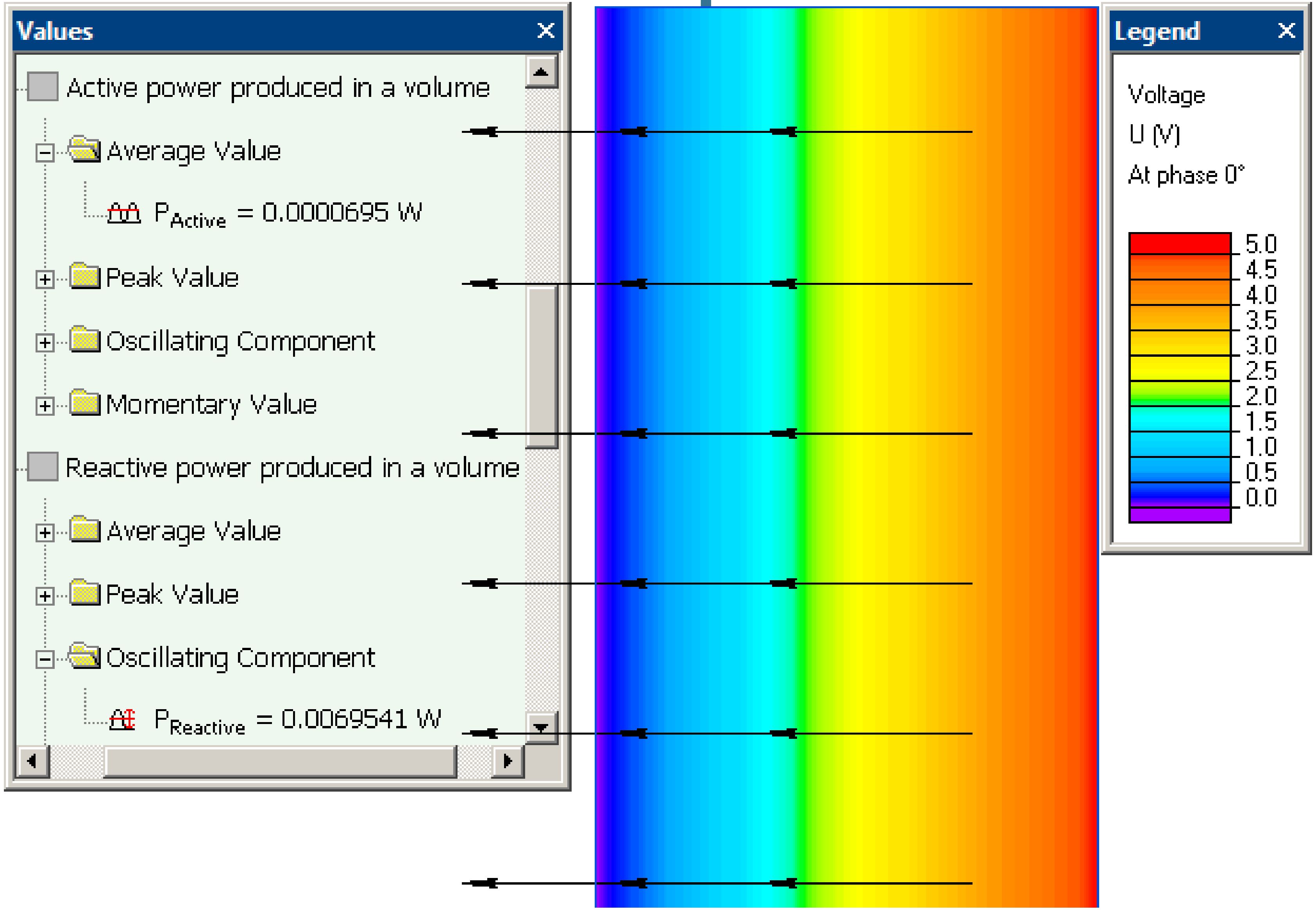
Loss tangent tan(δ) = 0.01

Task:

Calculate dielectric loss in the substrate.

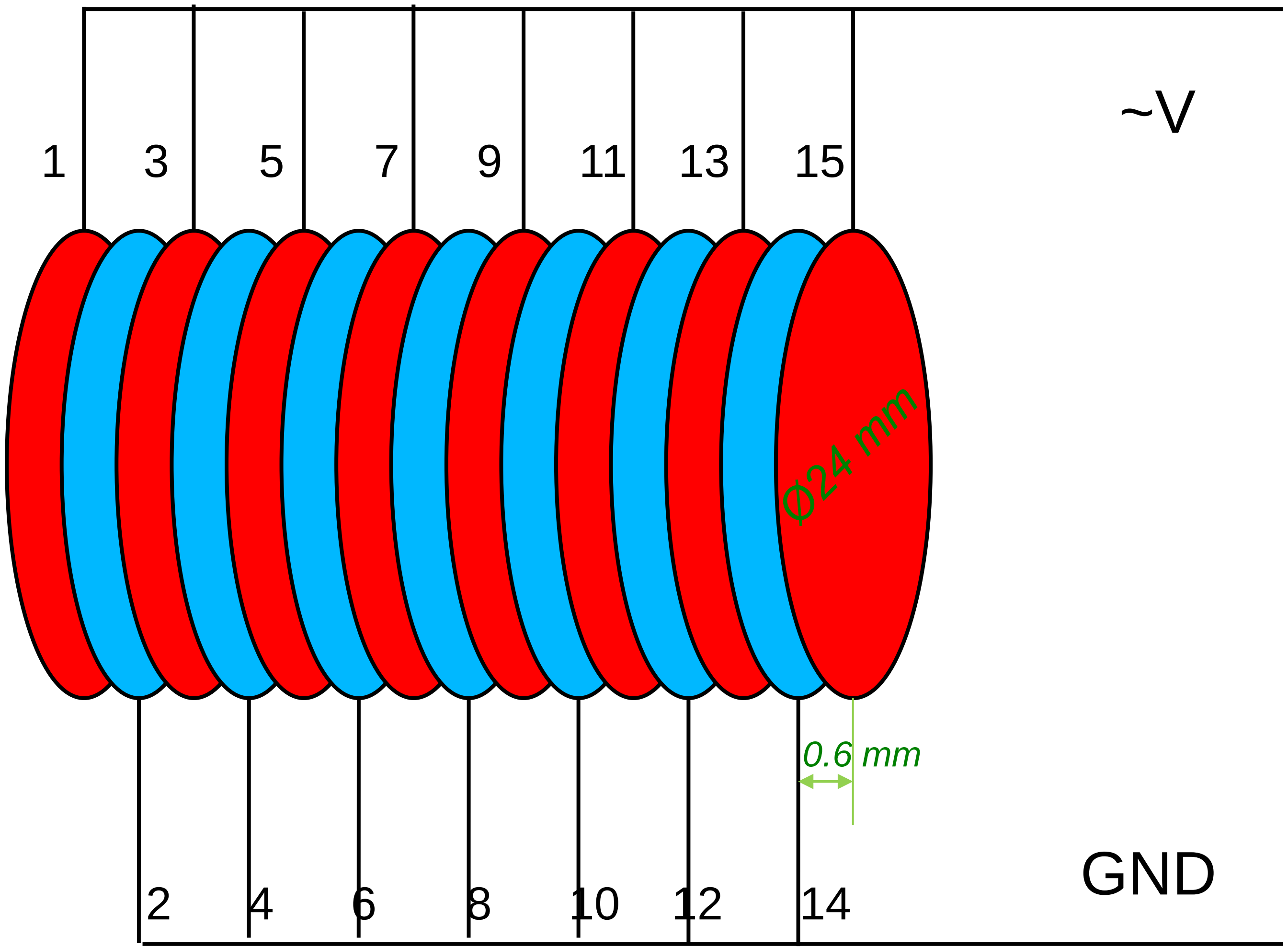
https://quickfield.com/advanced/acelec1.htm

Plane capacitor



https://quickfield.com/advanced/acelec1.htm

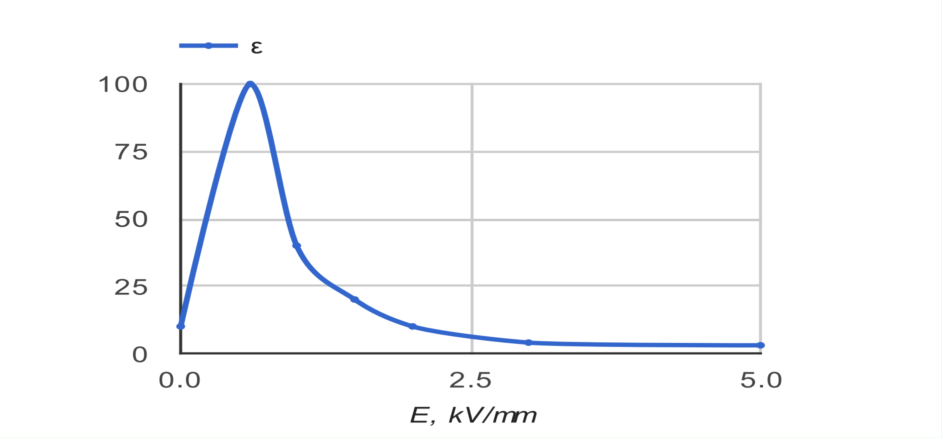
Nonlinear capacitor



Problem specification:

Voltage 240 V, frequency f =50 Hz

Relative permittivity ε of dielectric material:

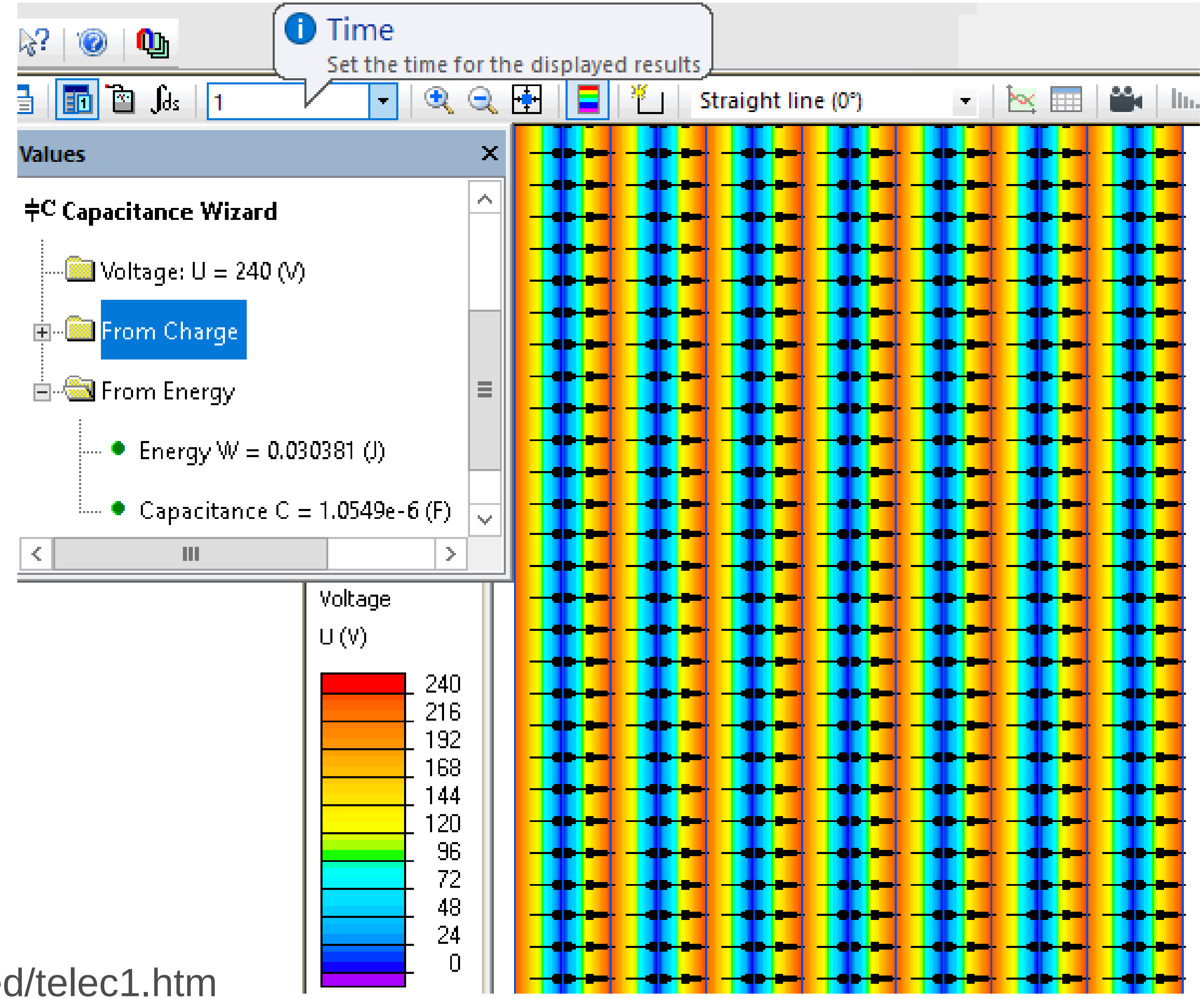


Task:

Calculate current as a function of time.

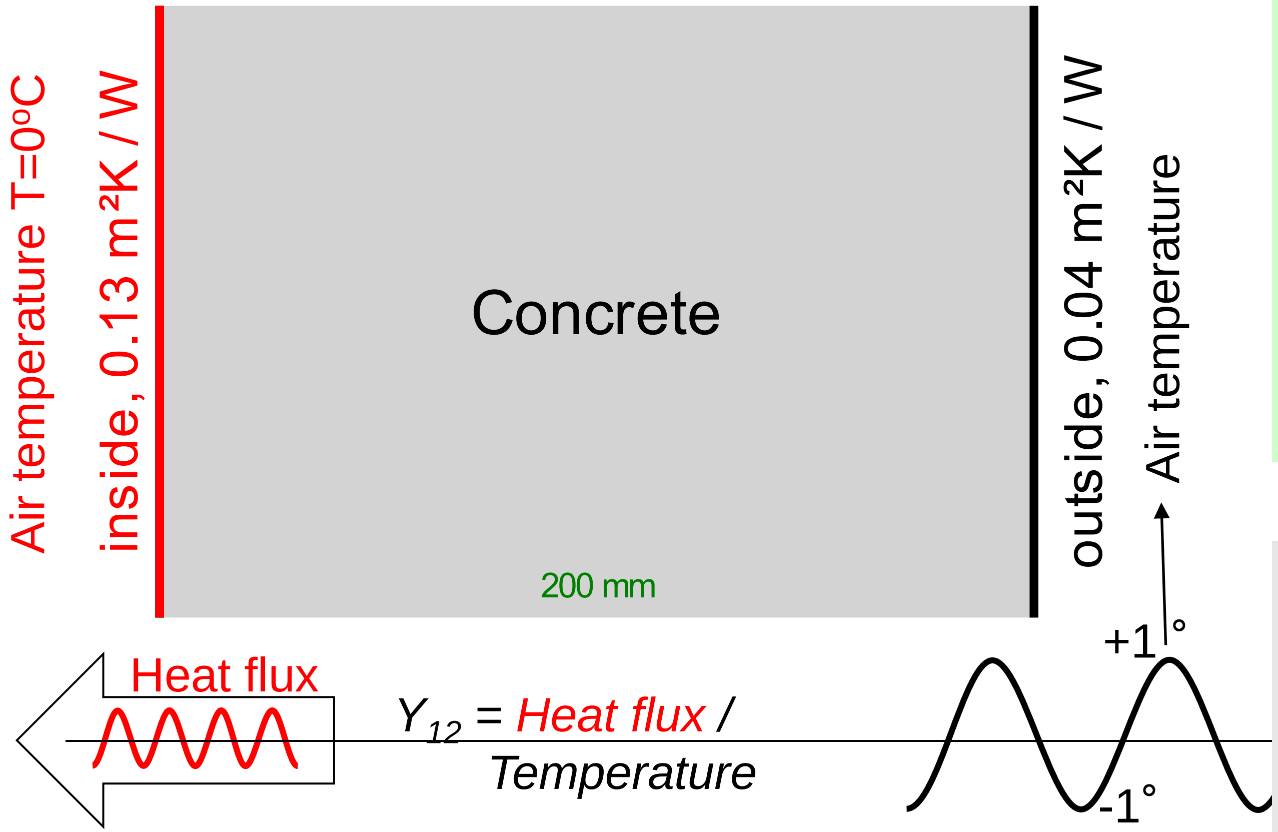
https://quickfield.com/advanced/telec1.htm

Nonlinear capacitor



https://quickfield.com/advanced/telec1.htm

ISO 13786-2017. Periodic thermal transmittance



Problem specification:

A homogeneous concrete wall with periodically changing temperature on its surface. Period of thermal variations T=24 hours.

Thermal conductivity λ = 1.8 W/K-m
Density ρ = 2400 kg/m³
Specific heat capacity C = 1000 J/kg-K

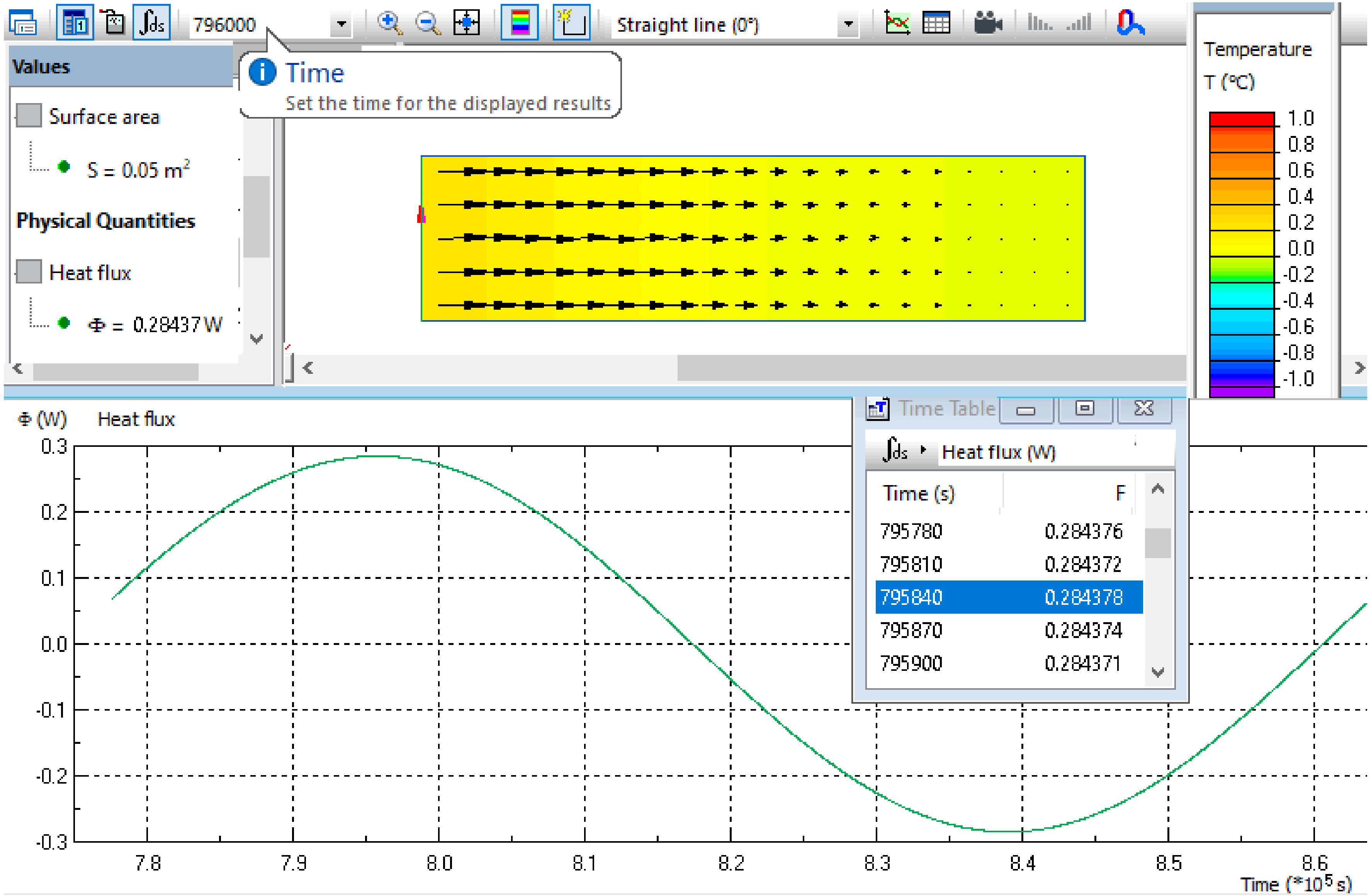
Task:

Calculate periodic thermal transmittance.

Periodic thermal transmittance Y_{12} is amplitude of the density of heat flow rate on one side when the temperature amplitude on that side is zero and there is a unit temperature amplitude on the other side.

https://quickfield.com/advanced/iso_13786_2007_case_d1.htm

ISO 13786-2017. Periodic thermal transmittance



https://quickfield.com/advanced/iso_13786_2007_case_d1.htm

This recording is over

More recordings and simulation examples at www.quickfield.com

Your feedback is welcome: support@quickfield.com