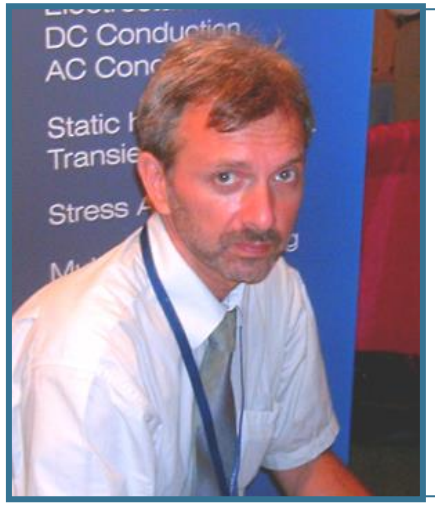
# Transient problems modelling with QuickField




**Vladimir Podnos**

**Director of Marketing and Support**
**Tera Analysis Ltd.**

**Alexander Lyubimtsev**

**Support Engineer**
**Tera Analysis Ltd.**

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

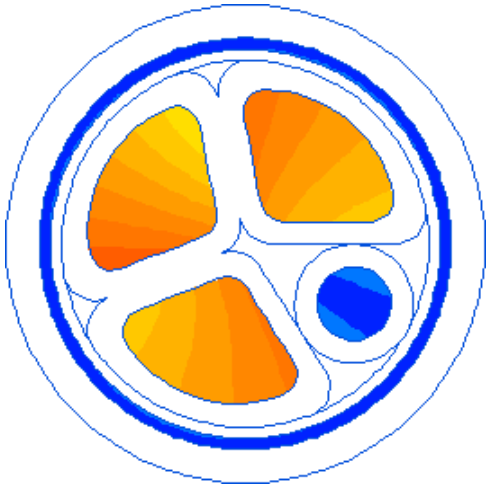
# QuickField Analysis Options

| | |
|---|---|
| **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

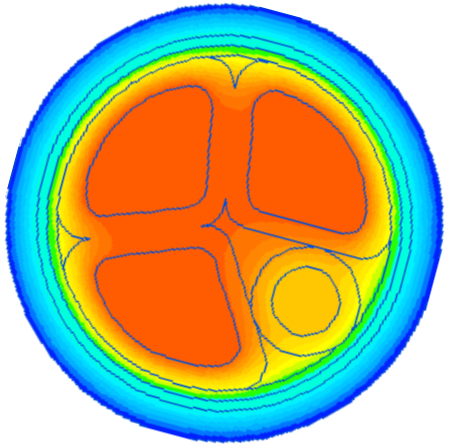
# MultiPhysics (2D)

Electromagnetic fields



Losses

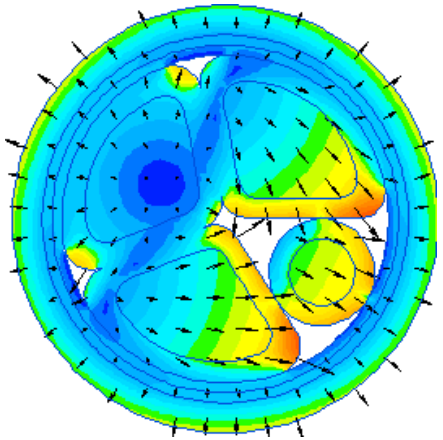
Temperature field



Temperature field import

Magnetic state import

Forces



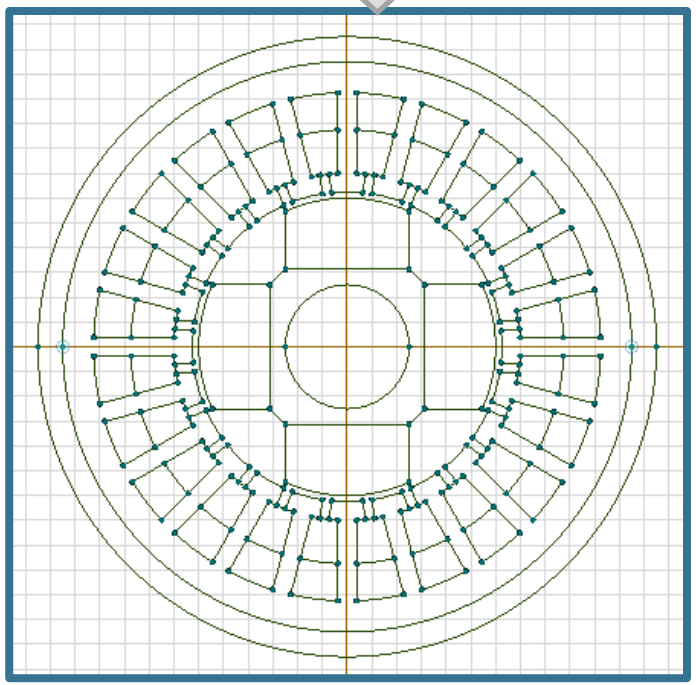
Thermal Stresses

Stresses & Deformations

https://quickfield.com/coupling.htm

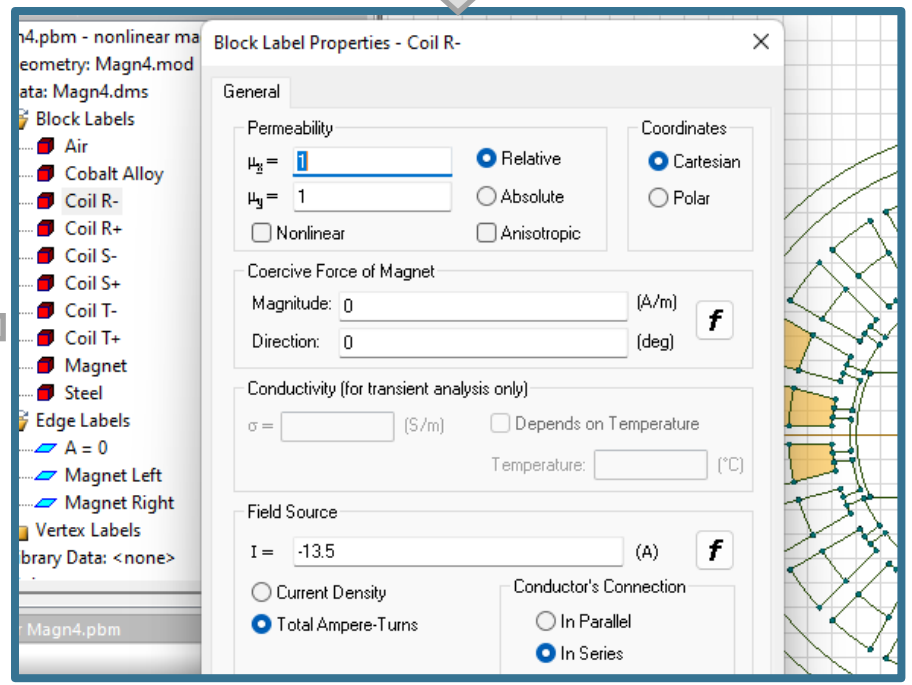
# QuickField Workflow

**Problem setup**



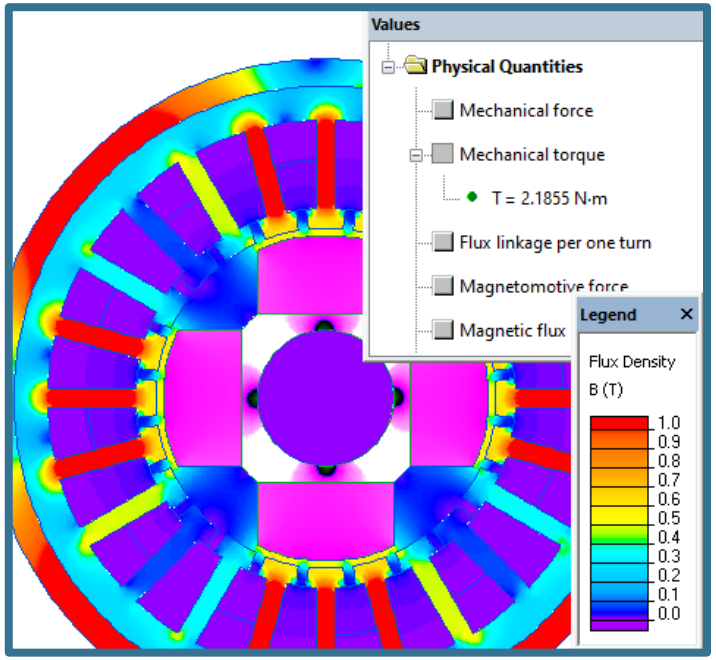
**Model editor**

+



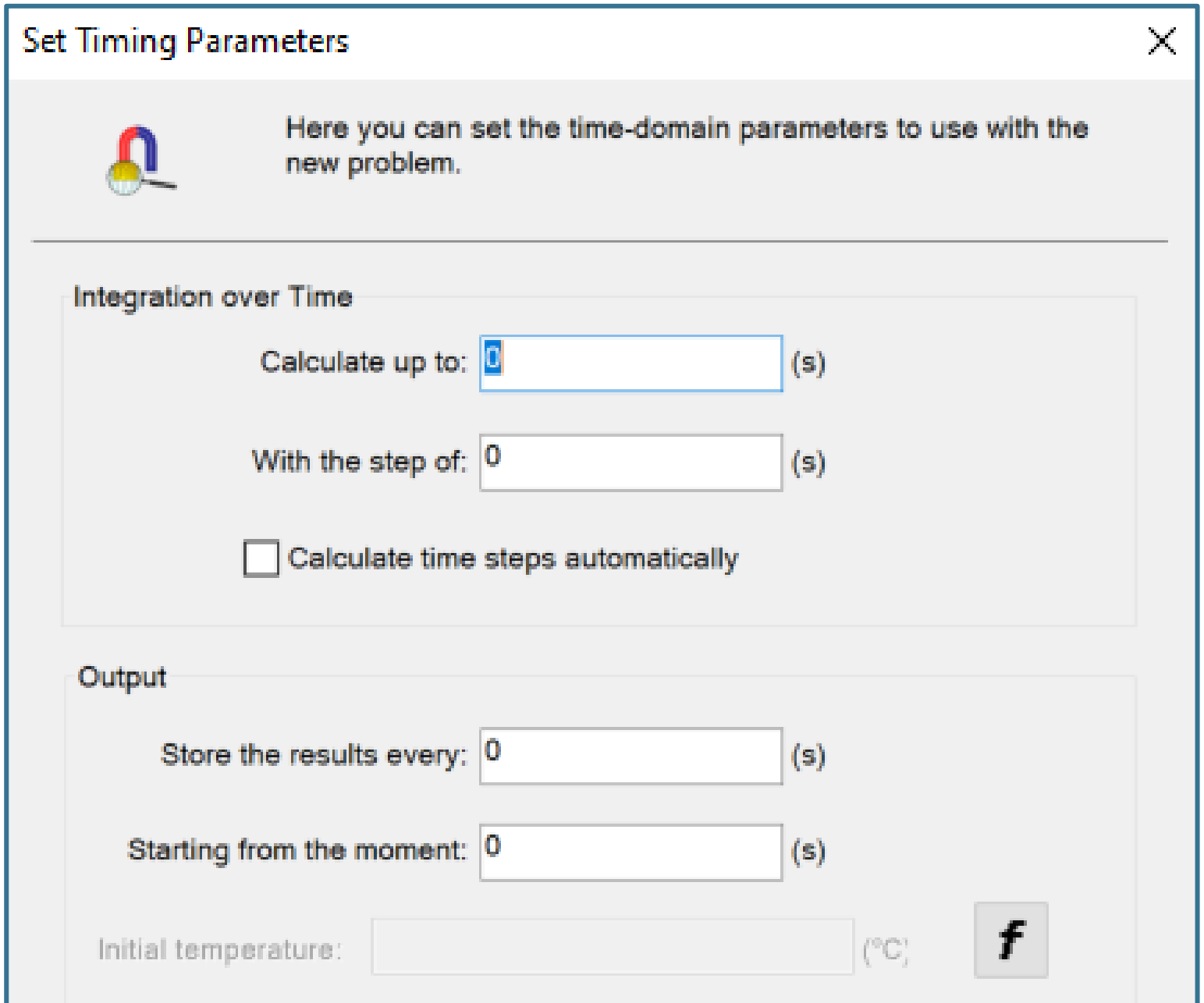

**Material physical properties, field sources and boundary conditions and time integration parameters**

=

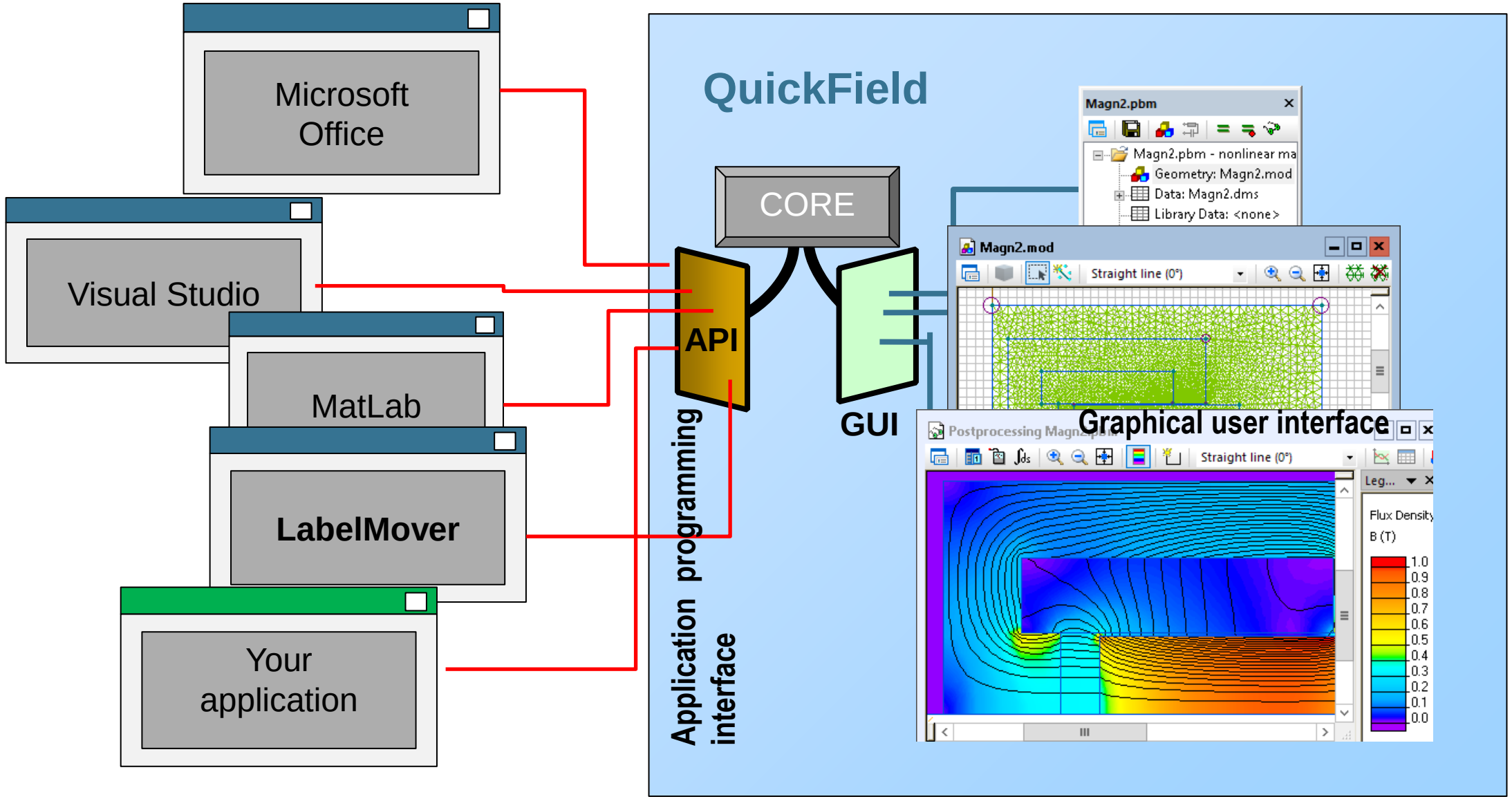



**Results analysis**

# Timing parameters



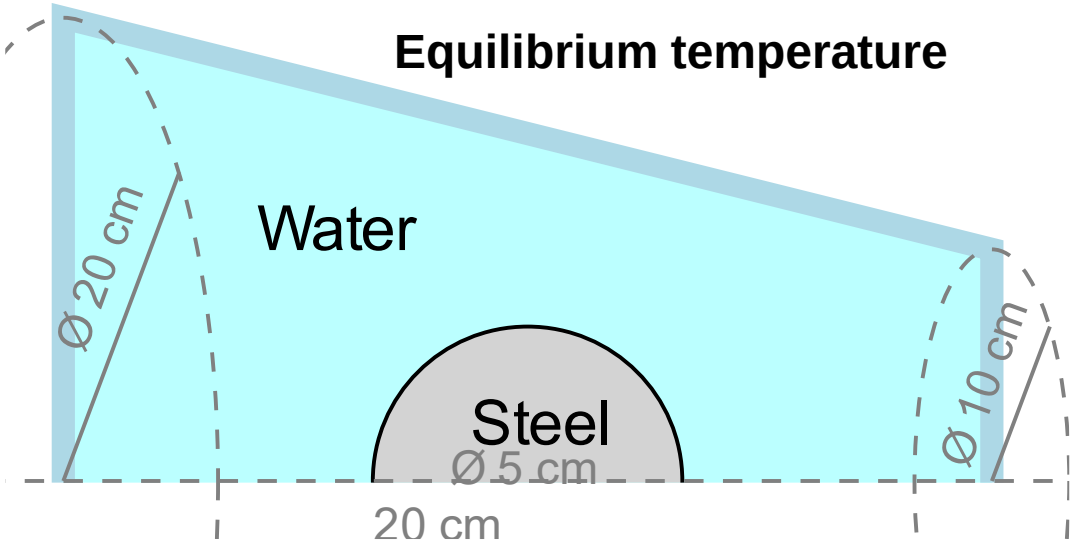
# QuickField API



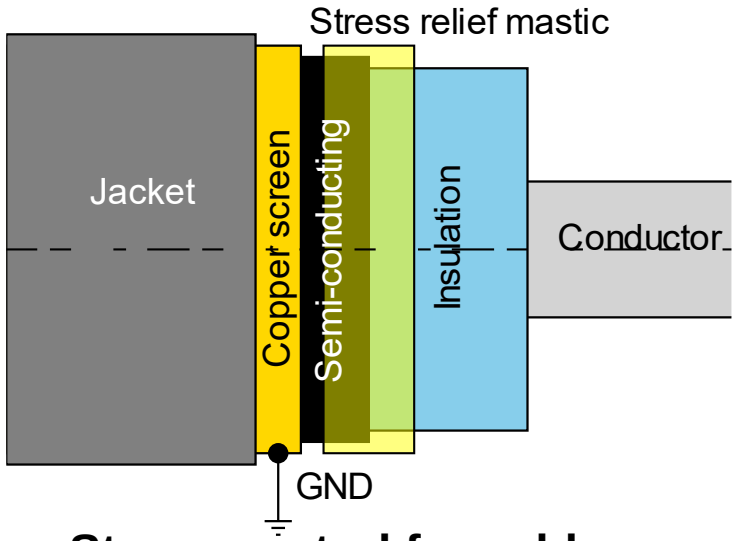

https://quickfield.com/programming.htm

# QuickField Difference

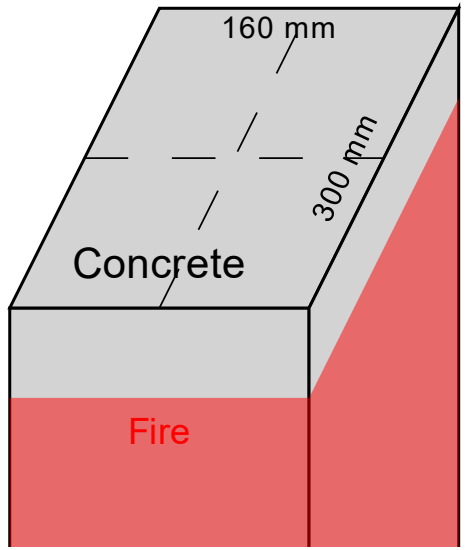
# Transient problems modelling with QuickField



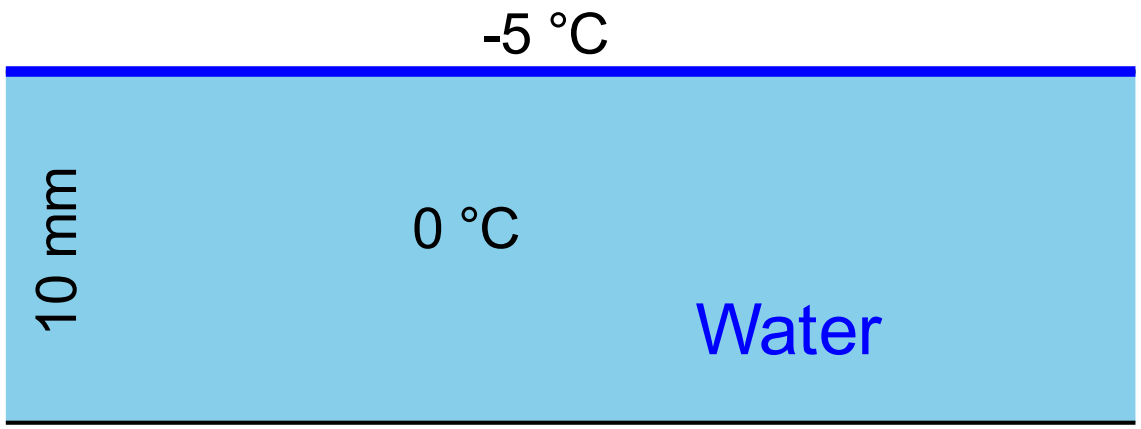

**Equilibrium temperature**



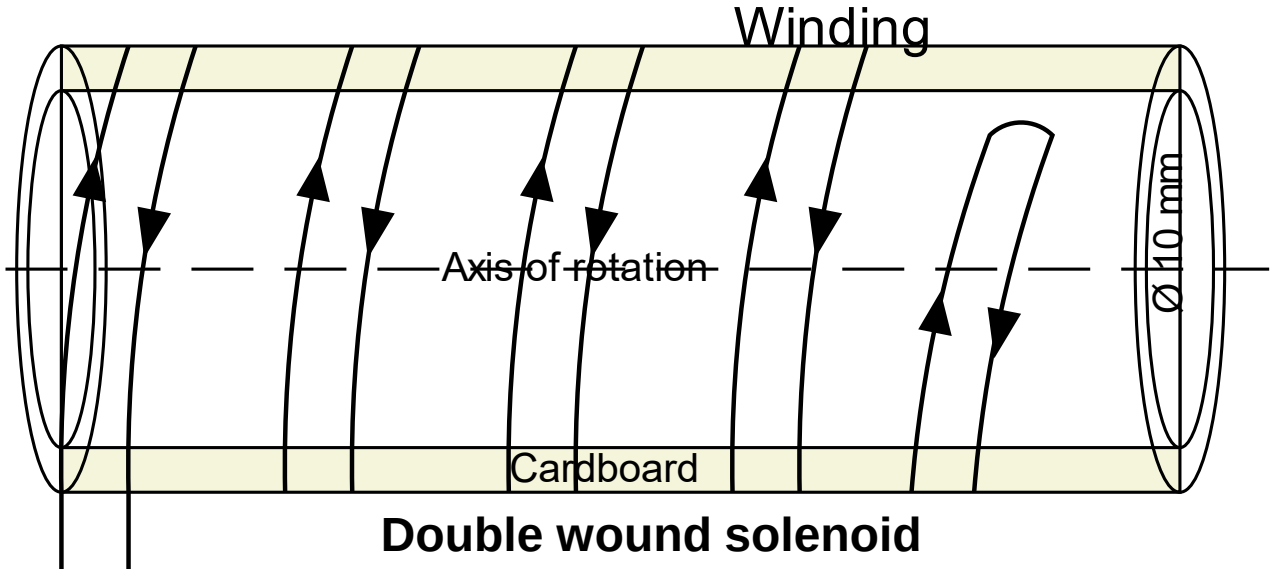

**Stress control for cable termination**




**EN 1992-1-2:2004. Structural fire design**




**Water liquid solid phase change**



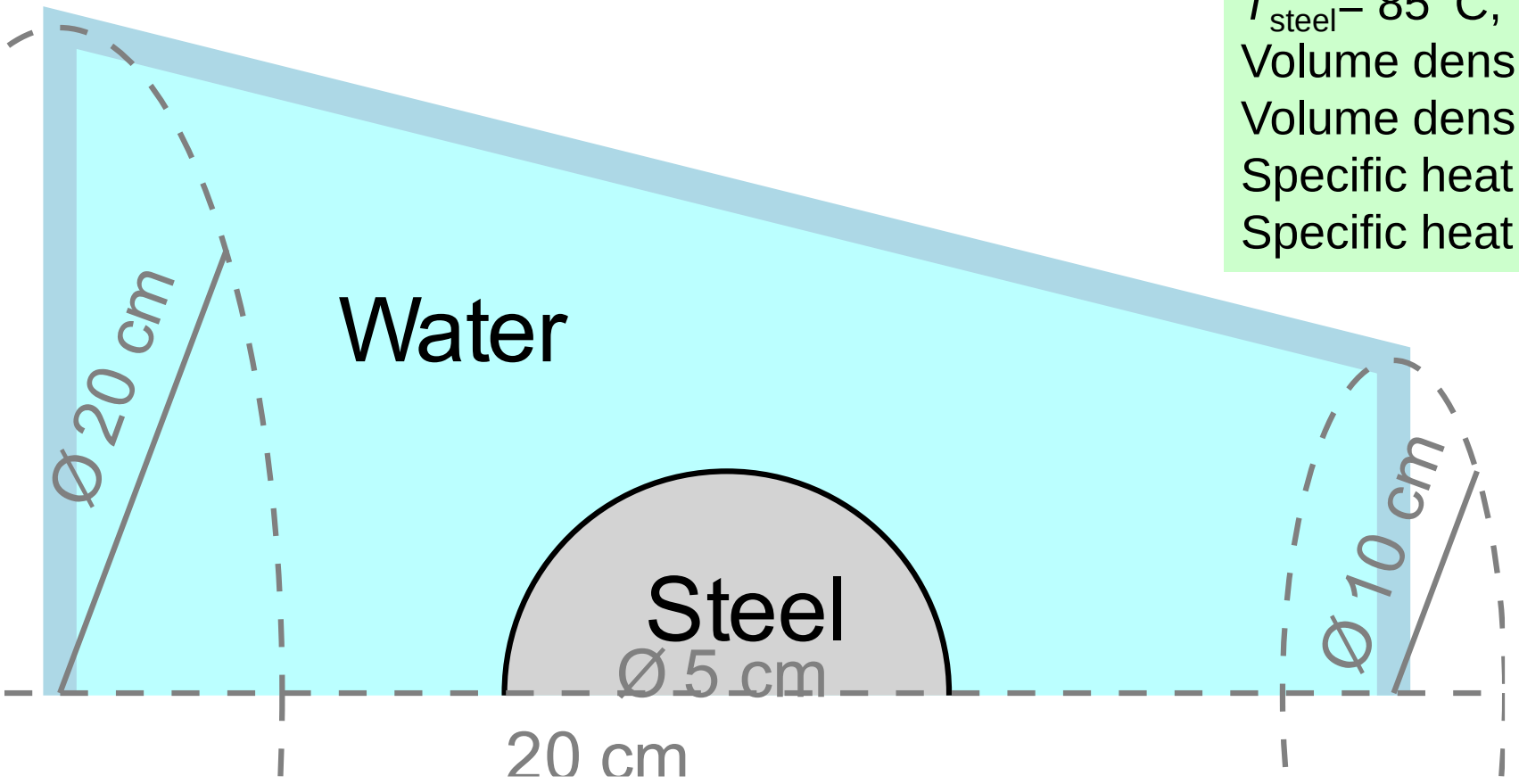

**Double wound solenoid**

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

# Equilibrium temperature

**Problem specification:**

$T_{steel}$= 85°C, $T_{water}$=20°C;
Volume density of steel $\rho_{steel}$ = 7800 kg/m³,
Volume density of water $\rho_{water}$ = 1000 kg/m³,
Specific heat of steel $C_{steel}$ = 460 J/kg·K,
Specific heat of water $C_{water}$ = 4200 J/kg·K.

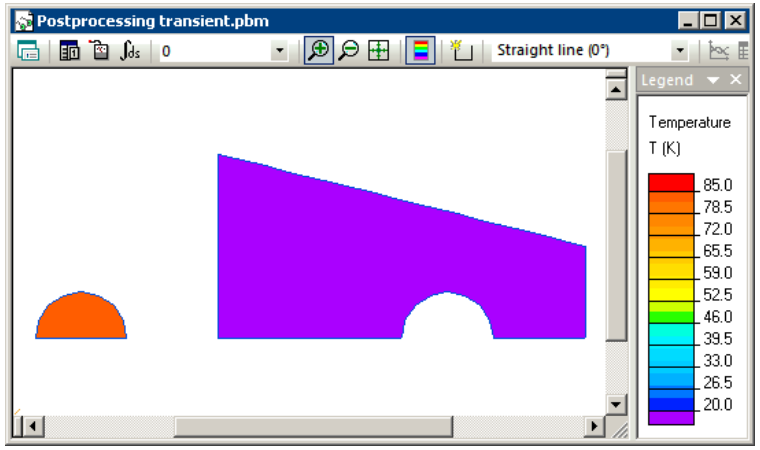


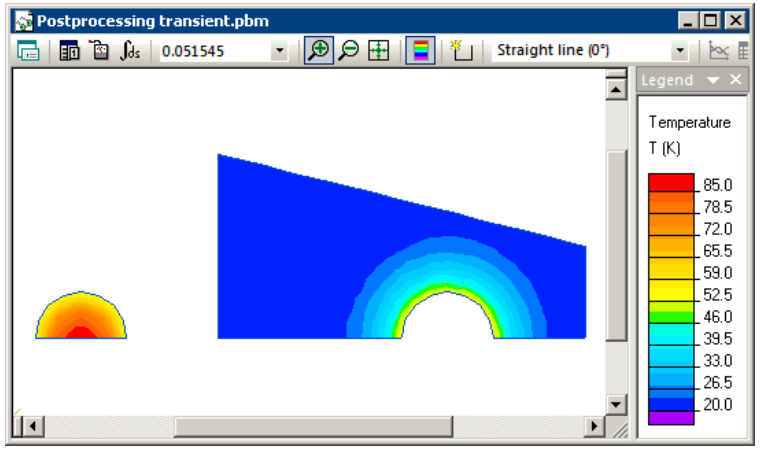

**Task:**

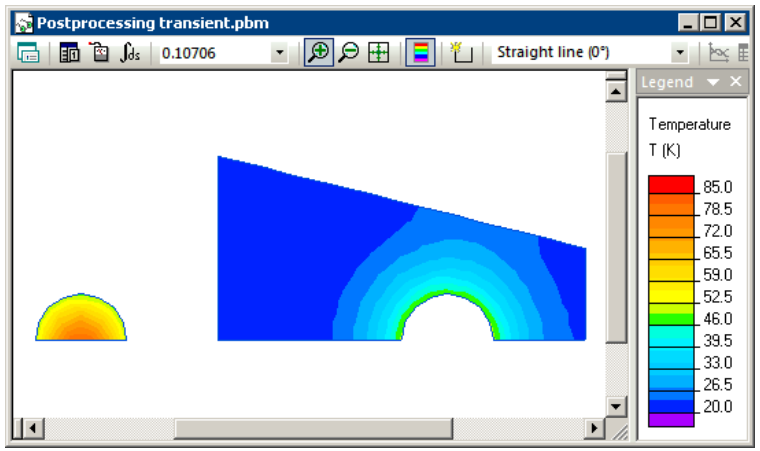
Calculate the equilibrium temperature.

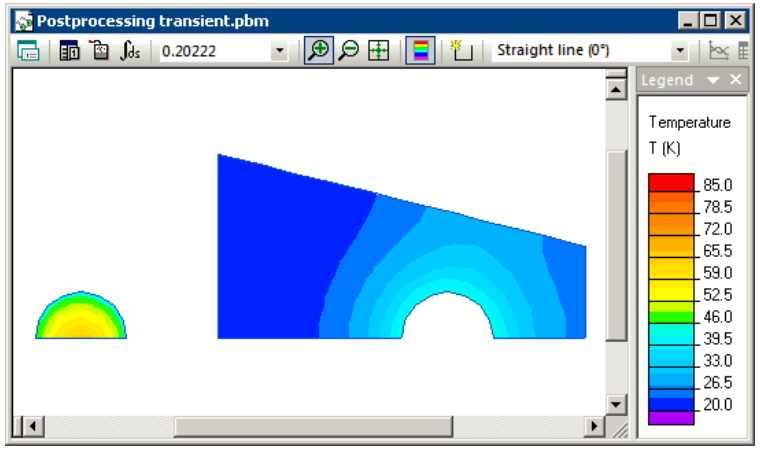
https://quickfield.com/advanced/heat_exchange.htm

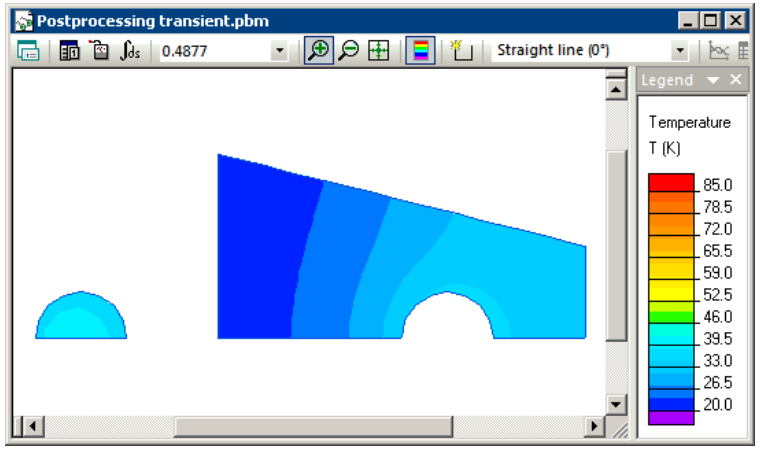
# Equilibrium temperature

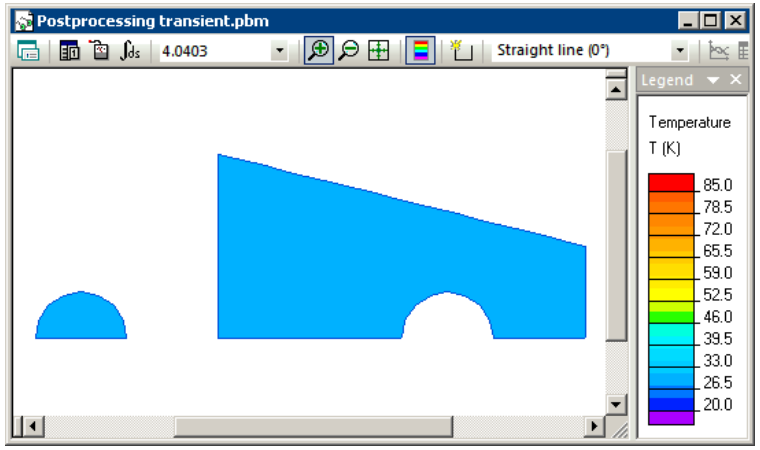


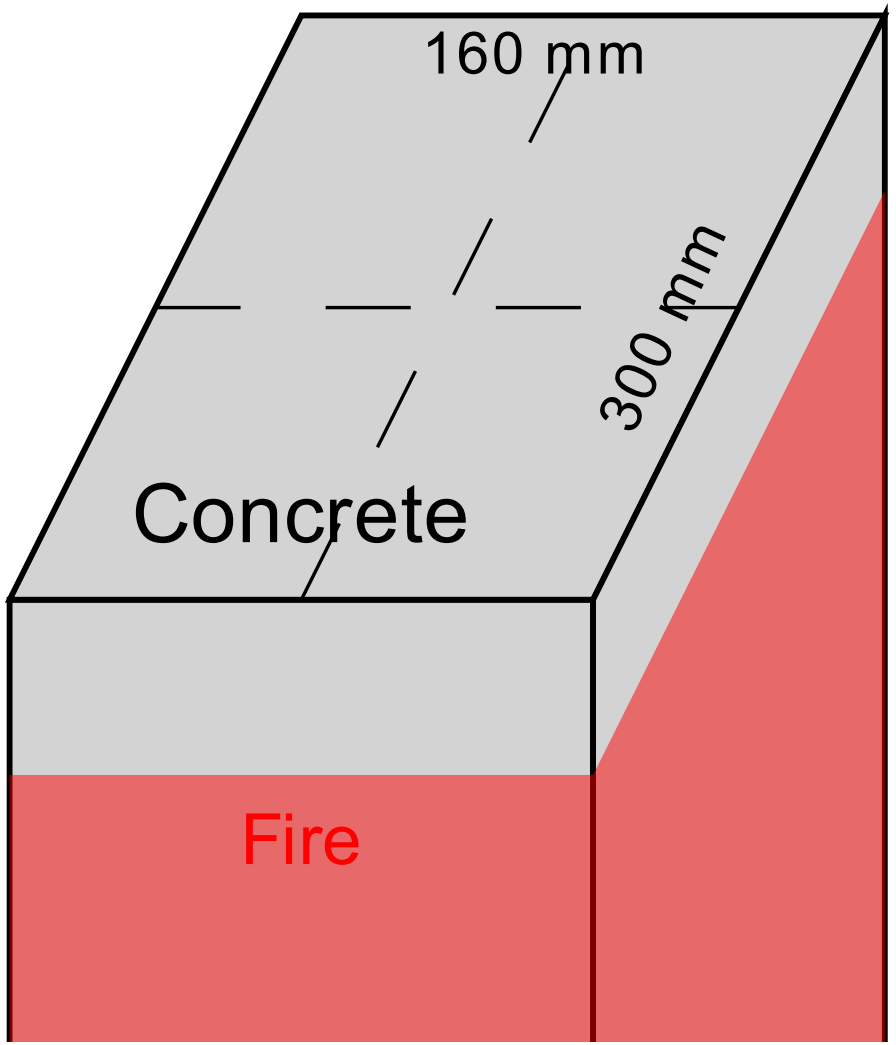




https://quickfield.com/advanced/heat_exchange.htm

# EN 1992-1-2:2004**. Structural fire design




**Problem specification:**

The standard fire temperature-time curve is defined by the ISO 834*:
$T(t) = T_0 + 345*\log_{10}(8*t + 1)$, where $t$ is time in minutes and $T_0$=20°C is an initial temperature.

Convection coefficient is 25 W/K-m²,
emissivity coefficient of concrete surface is 0.7.

Concrete thermal conductivity, specific heat capacity and density depend on temperature.

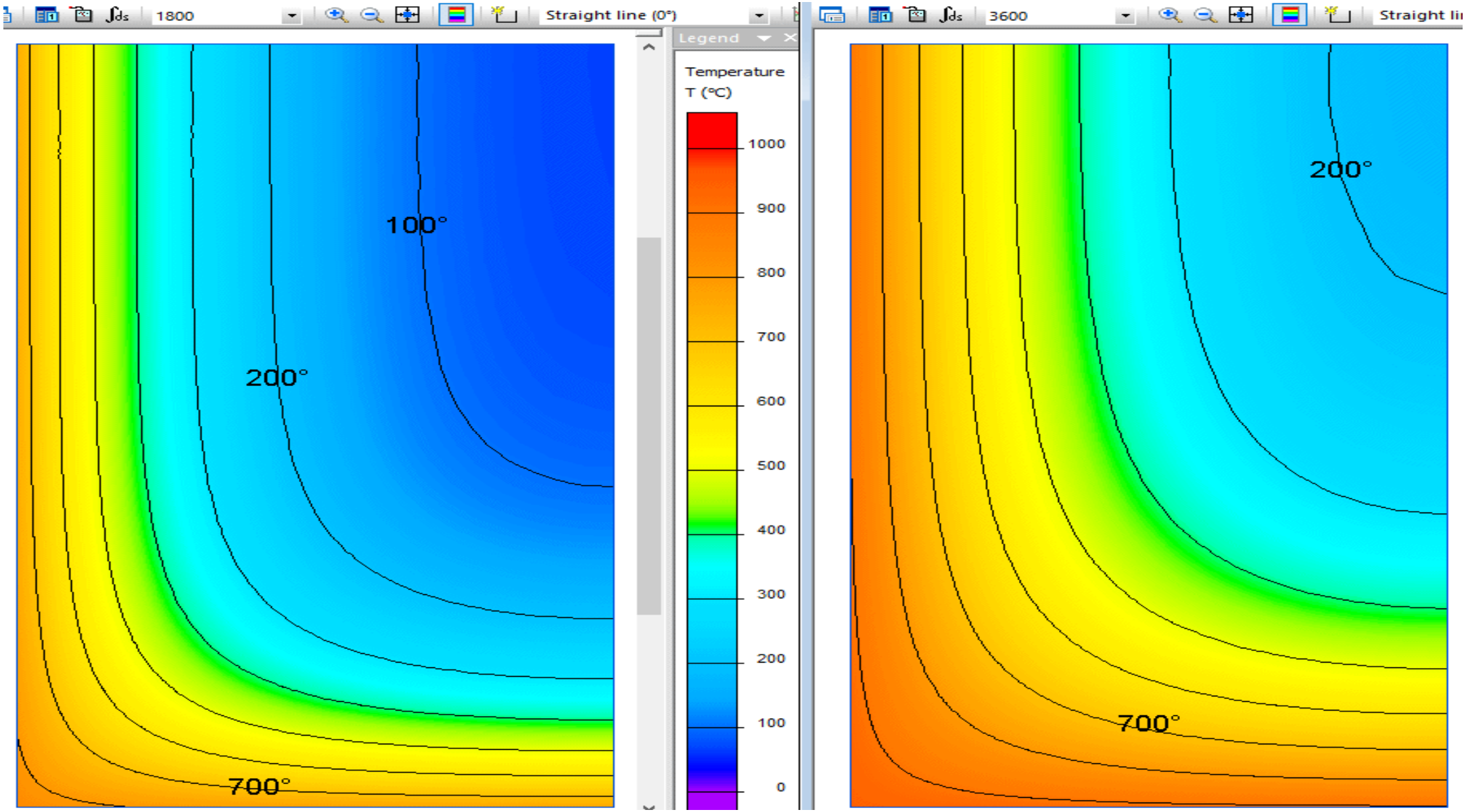
**Task:**

Calculate the temperature field.

* ISO 834-1:1999. Fire-resistance tests — Elements of building construction — Part 1: General requirements
** EN 1992-1-2:2004 Design of concrete structures - Part 1-2: General rules - Structural fire design.

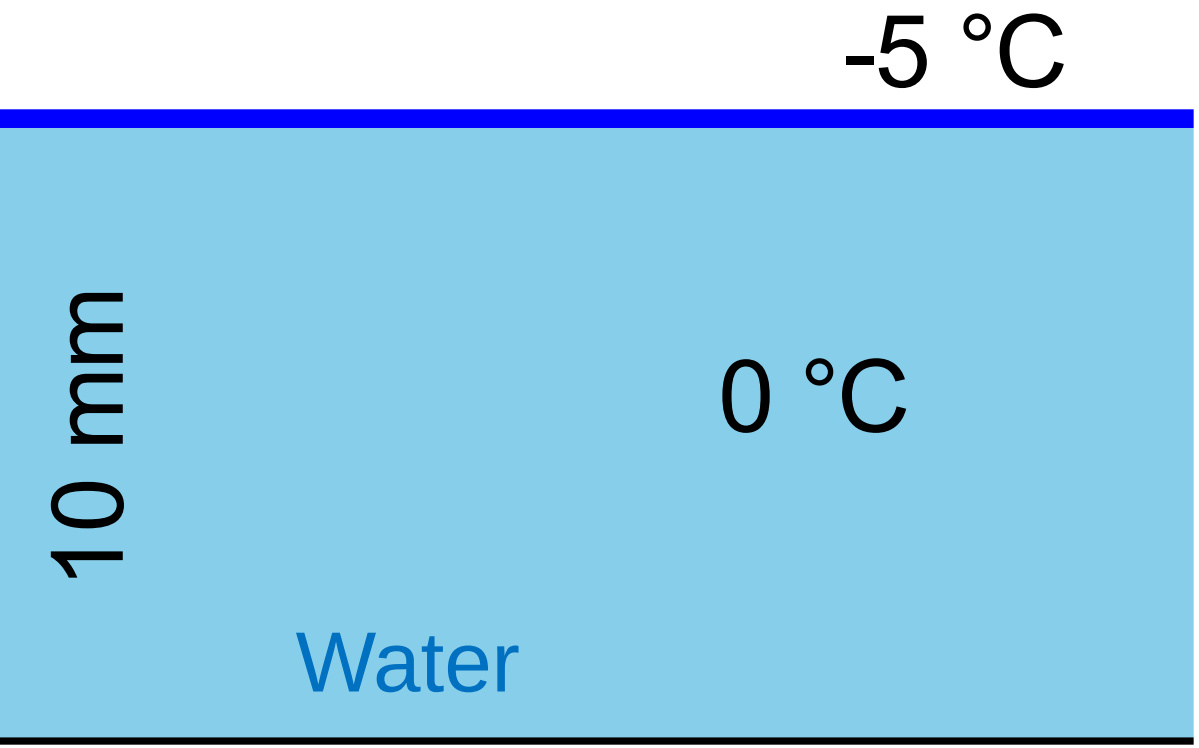
https://quickfield.com/advanced/en1992-1-2_2004.htm

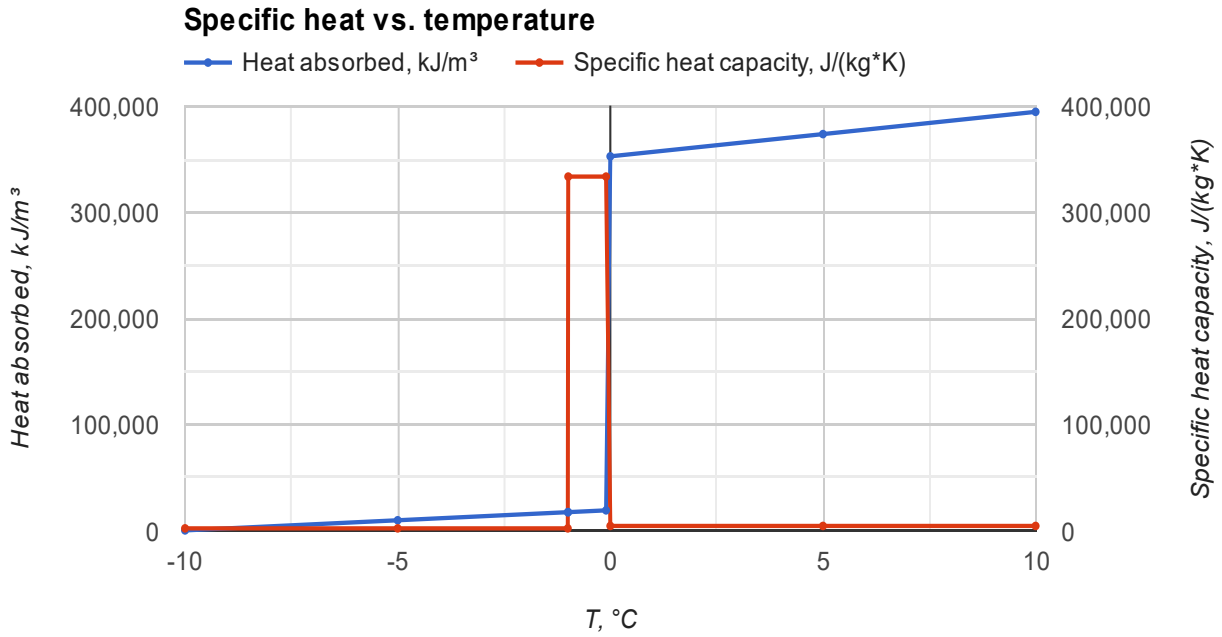
# EN 1992-1-2:2004. Structural fire design




https://quickfield.com/advanced/en1992-1-2_2004.htm

# Water liquid solid phase change




**Problem specification:**

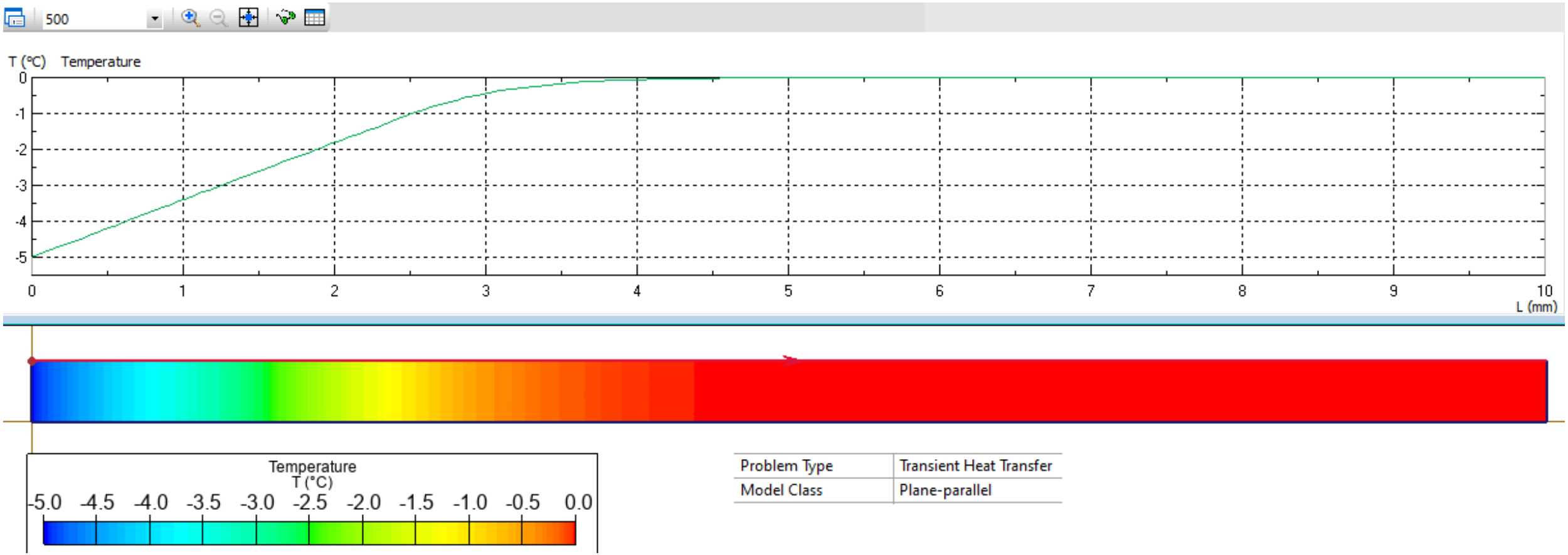
Water thermal conductivity 0.6 W/K-m, density 1000 kg/m³, specific heat $C$ = 4200 J/(kg*K). Latent heat of fusion $L_f$ = *334 kJ/kg.*

**Task:**

Calculate the temperature distribution in the ice.

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

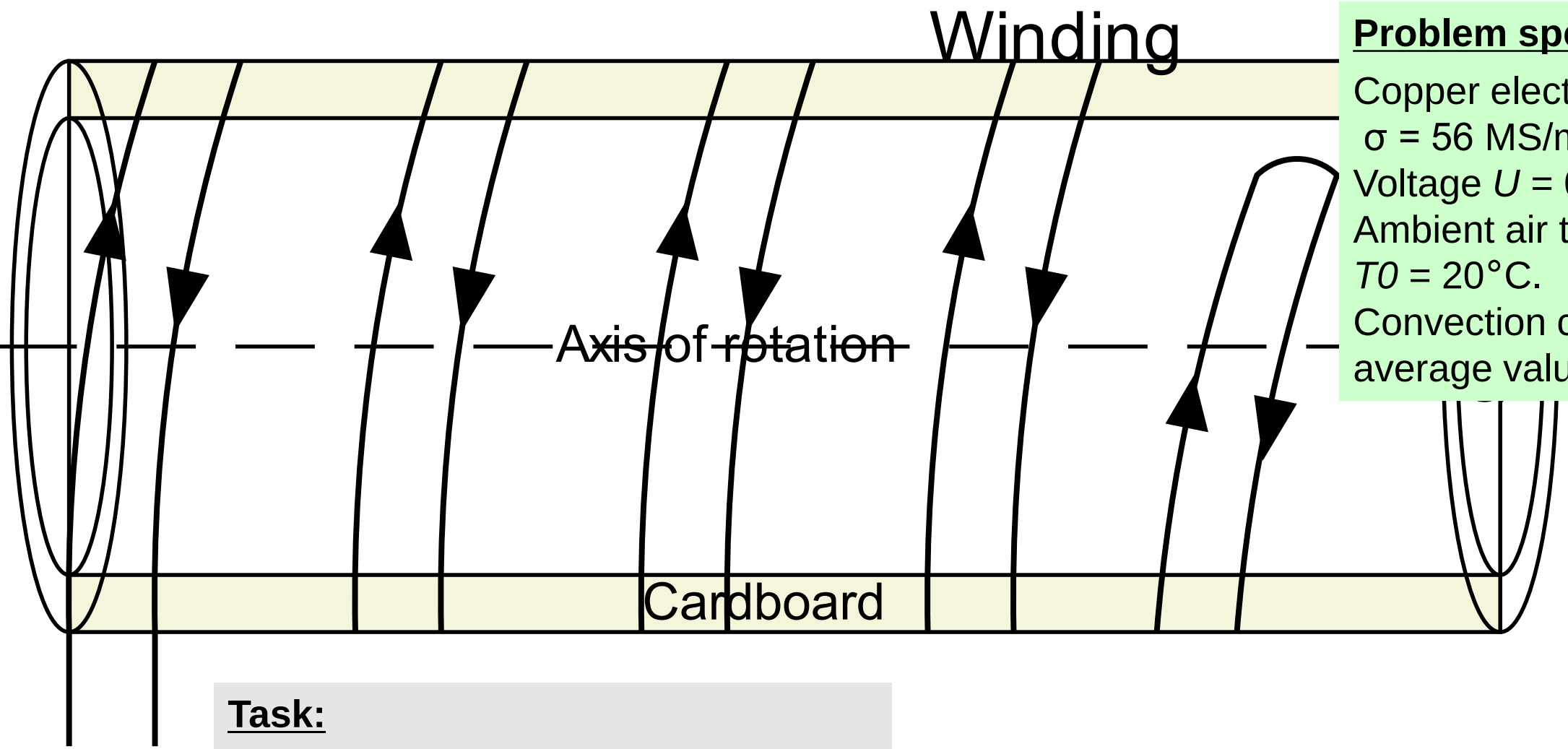
# Water liquid solid phase change




| | |
|---|---|
| Problem Type | Transient Heat Transfer |
| Model Class | Plane-parallel |

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

# Double wound solenoid




**Problem specification:**

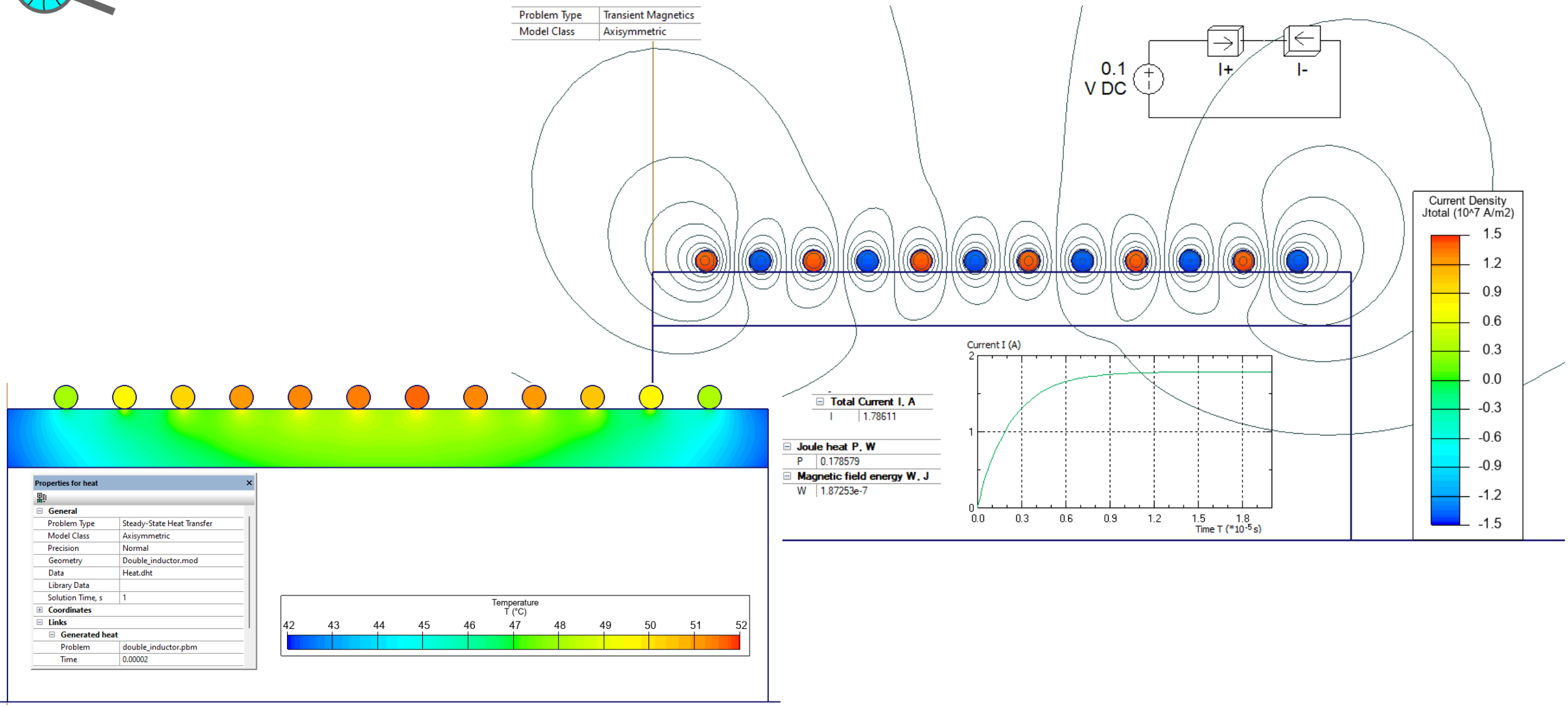
Copper electric conductivity σ = 56 MS/m.
Voltage *U* = 0.1 V.
Ambient air temperature *T0* = 20°C.
Convection coefficient average value α = 5 W/K-m².

**Task:**

Calculate current rise dynamics.

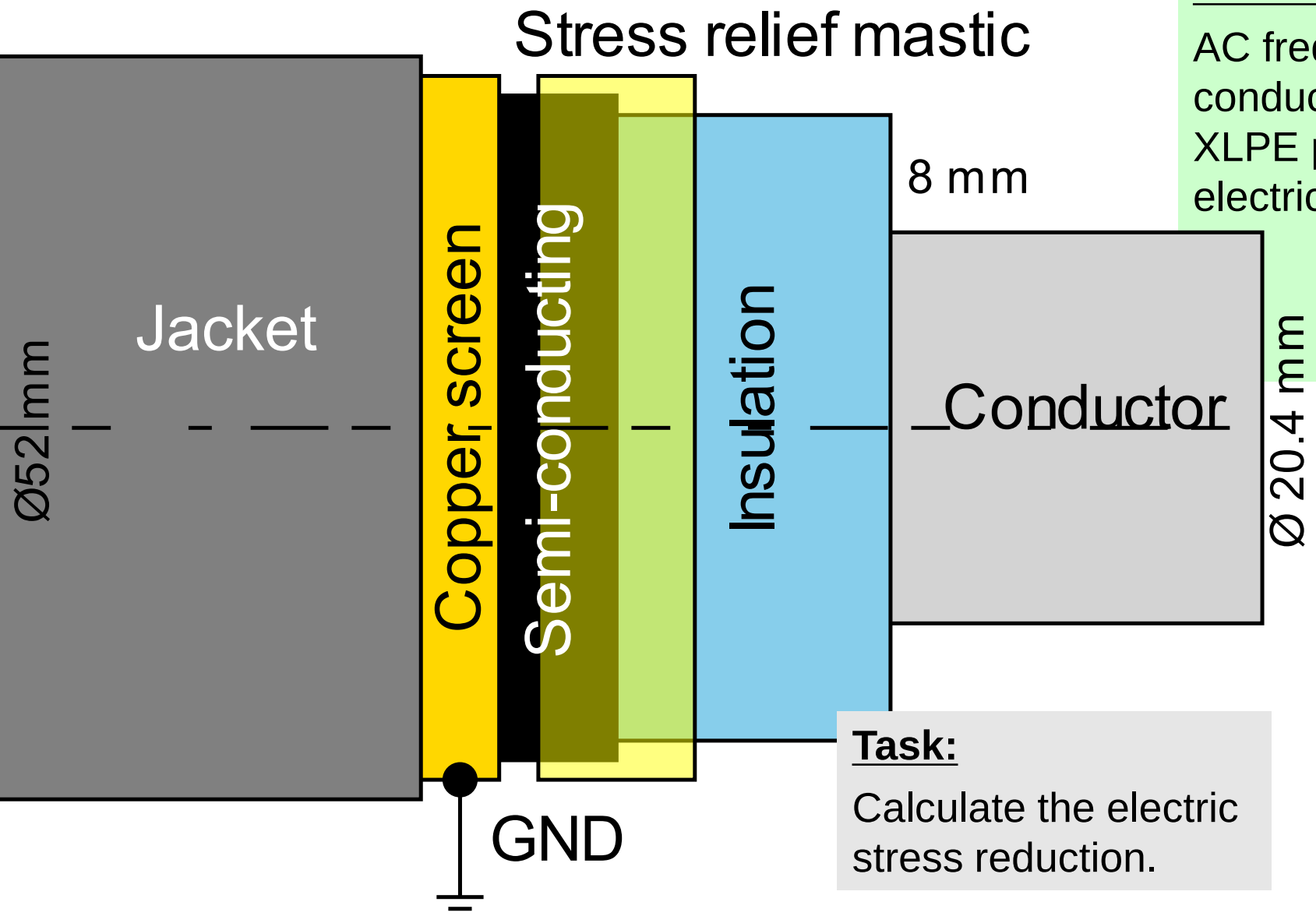
https://quickfield.com/advanced/double_wound_solenoid.htm

# Double wound solenoid



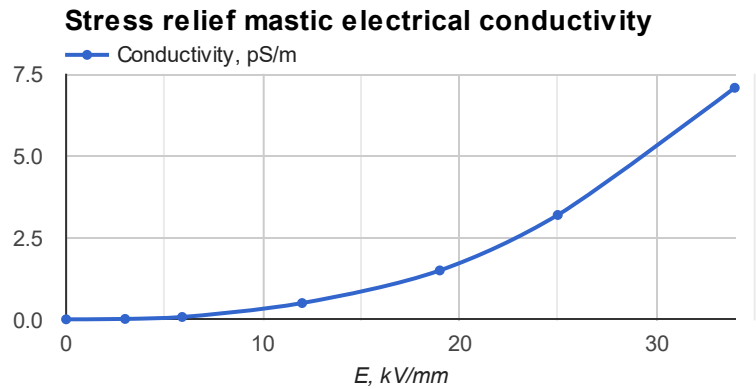

https://quickfield.com/advanced/double_wound_solenoid.htm

# Stress control tube for cable termination




**Problem specification:**

AC frequency *f*=50 Hz,
conductor potential *V* = 33 kV (r.m.s.).
XLPE permittivity 2.5. Insulation materials electrical conductivity 1e-15 S/m.
Yellow mastic permittivity is 15, electrical conductivity is field-dependent.

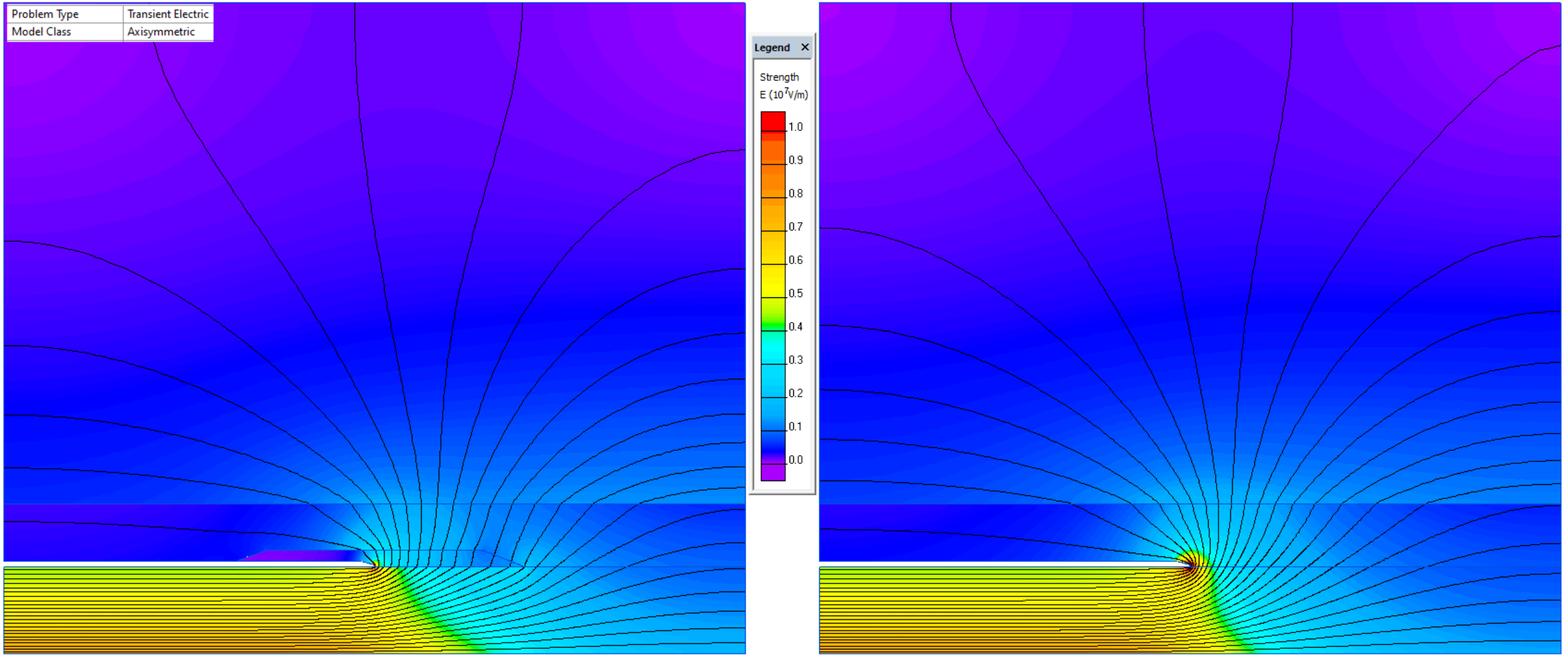



**Task:**

Calculate the electric stress reduction.

https://quickfield.com/advanced/telec3.htm

# Stress control tube for cable termination




https://quickfield.com/advanced/telec3.htm

# This recording is over

## More recordings and simulation examples at www.quickfield.com

Your feedback is welcome: support@quickfield.com