Transformers design. Part 2

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Introduction

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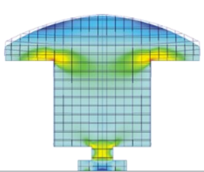
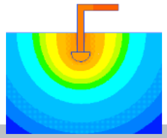
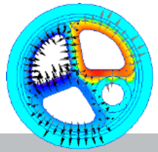
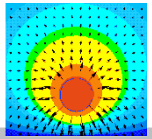
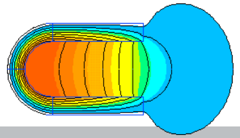
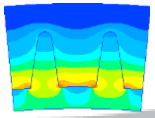
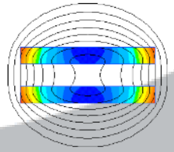
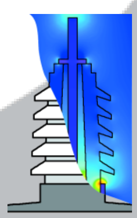
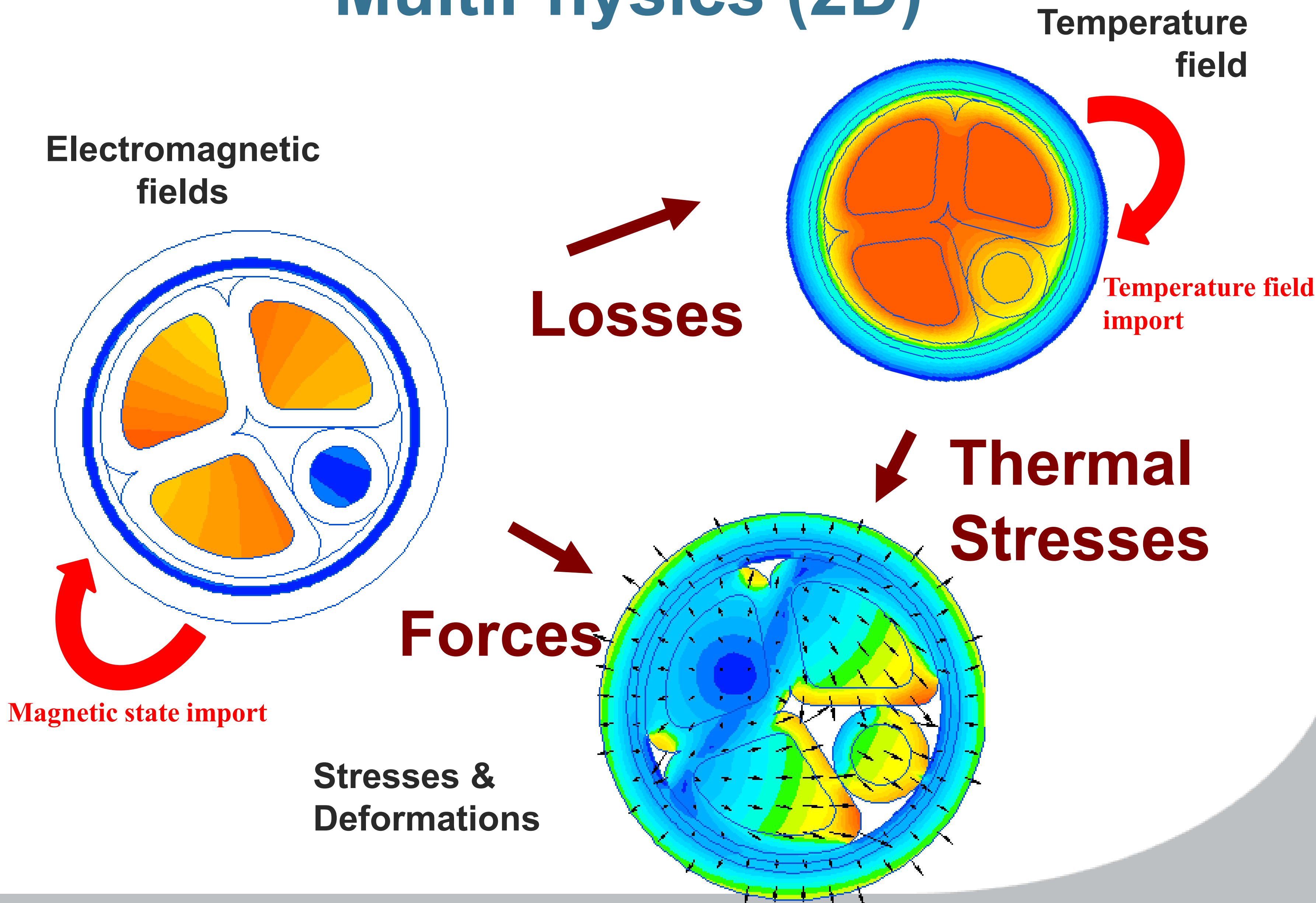
Live demonstration

QuickField Analysis Options

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

MultiPhysics (2D)

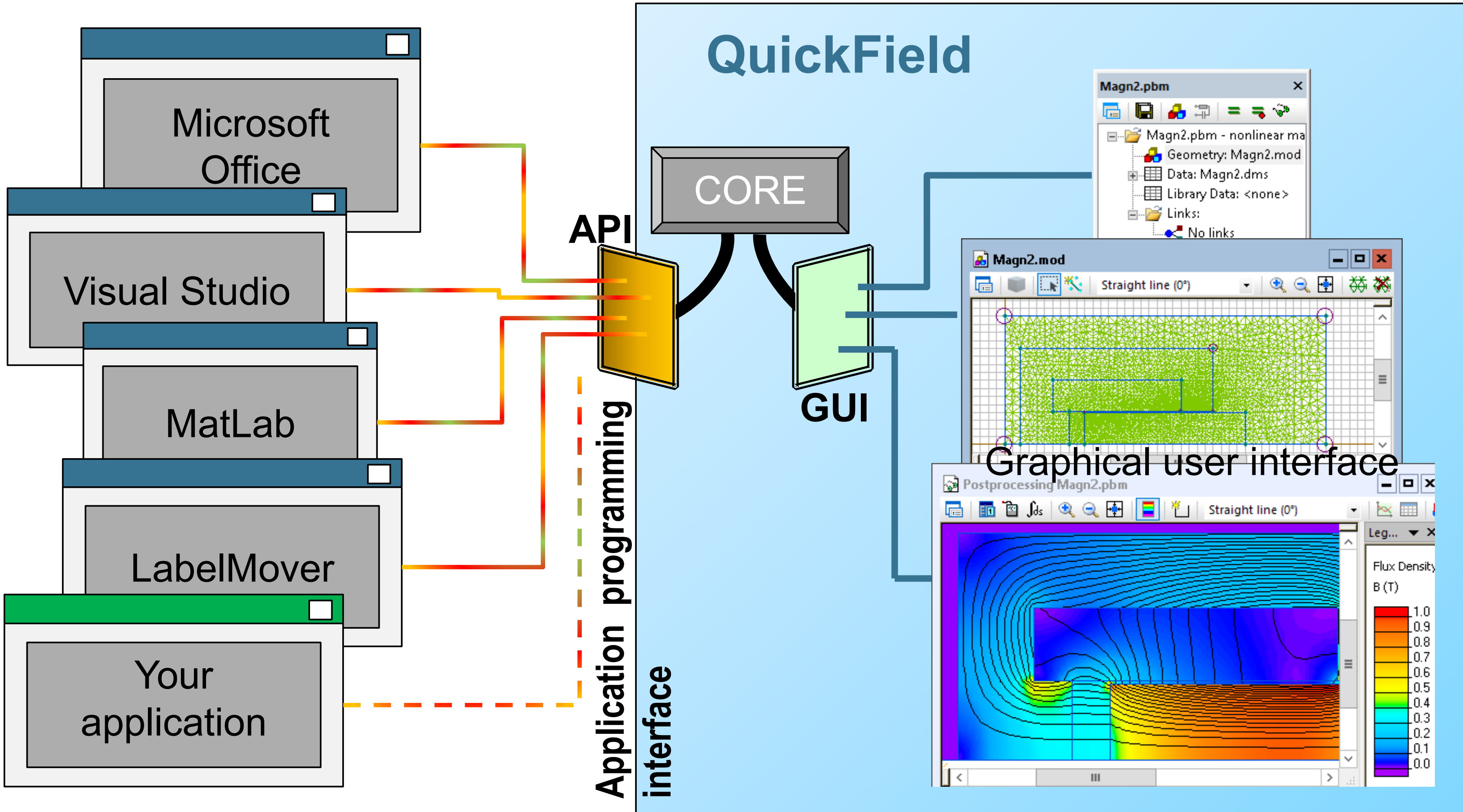


MultiPhysics (2D)

Source problem ---> |*Transferred data*|---> **Destination problem**

Destination: / **Source**:	DC magnetics	AC magnetics	Transient magnetics	Static heat transfer	Transient heat transfer	Stress Analysis
DC magnetics	Magnetic permeability	Magnetic permeability	Initial magnetic field			Force
AC magnetics				Joule heat	Joule heat	Force
Transient magnetics			Initial magnetic field	Joule heat	Joule heat	Force
Electrostatics						Force
DC conduction				Joule heat	Joule heat	
AC conduction				Joule heat	Joule heat	Force
Transient electric						
Static heat transfer		Temperature			Initial temperatures	Temperature
Transient heat transfer		Temperature			Initial temperatures	Temperature
Stress Analysis						

Open object interface



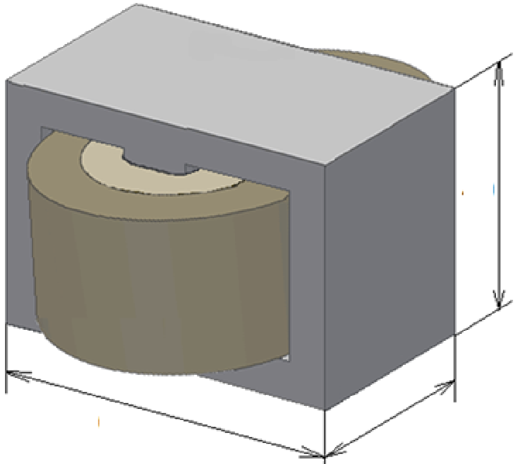
QuickField Difference

Field simulation software

www.QuickField.com

No training required

Transformers design. Part 1



1. Single phase transformer.
   No load test. Short circuit test.
2. Flyback (pulse) transformer EMC.
3. Three phase transformer. Nonsymmetrical load.
4. Transformer heating. Winding and core losses.
5. Mechanical stress in transformer windings.
6. Transformer tank 3-phase bushing insulator.

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

Transformers design. Part 2

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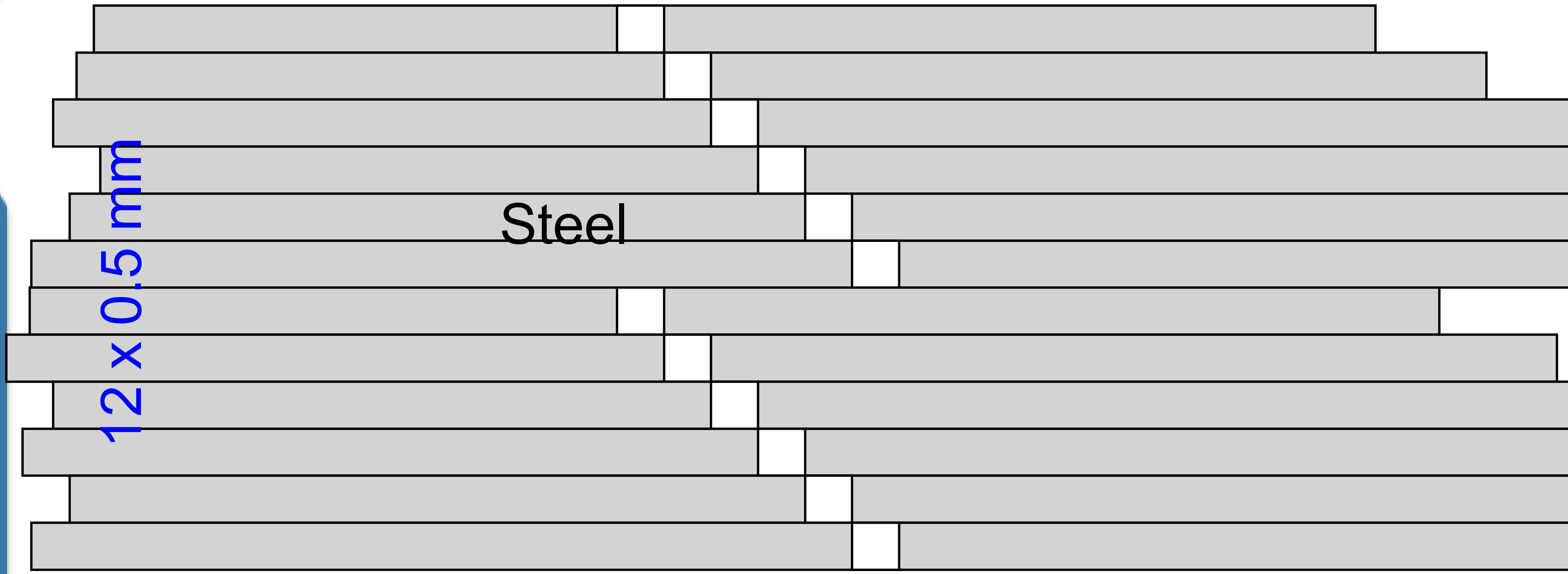
1. Step lap joint magnetic field
2. Welding transformer output power
3. Electric arc furnace transformer short circuit (transformer stray flux)
4. End-winding insulation
5. Oil electric stress 3D

https://quickfield.com/seminar/seminar_transformer2.htm

Step lap joint



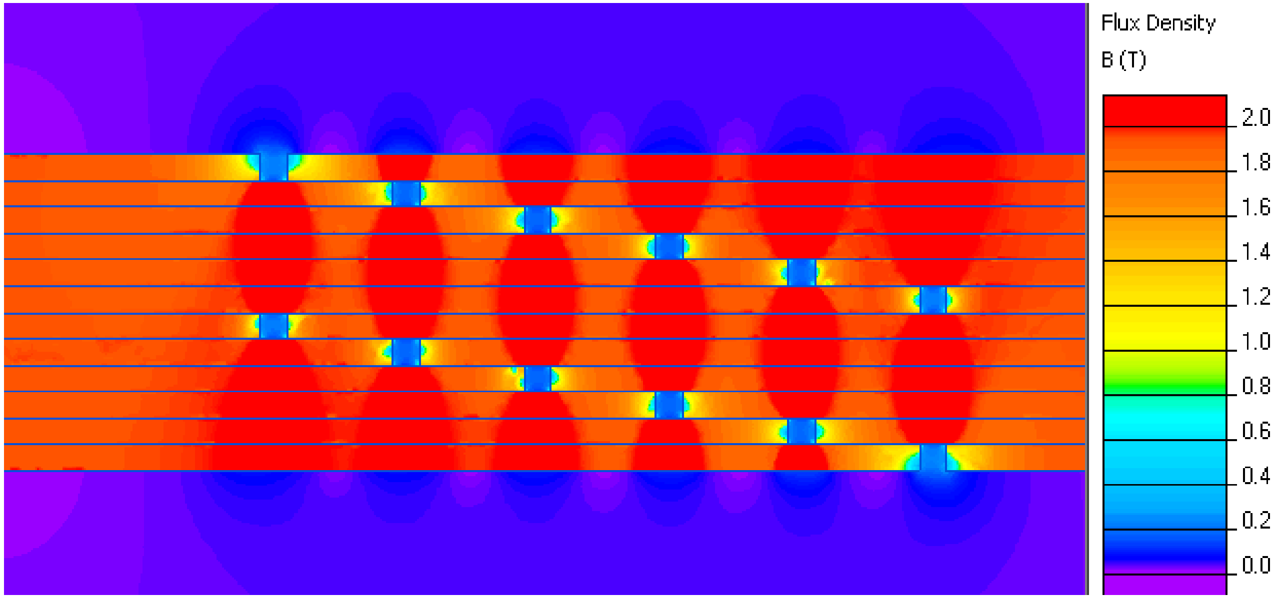
Problem specification:

Steel permeability – B(H) curve
Average magnetic flux density ~1.9 T

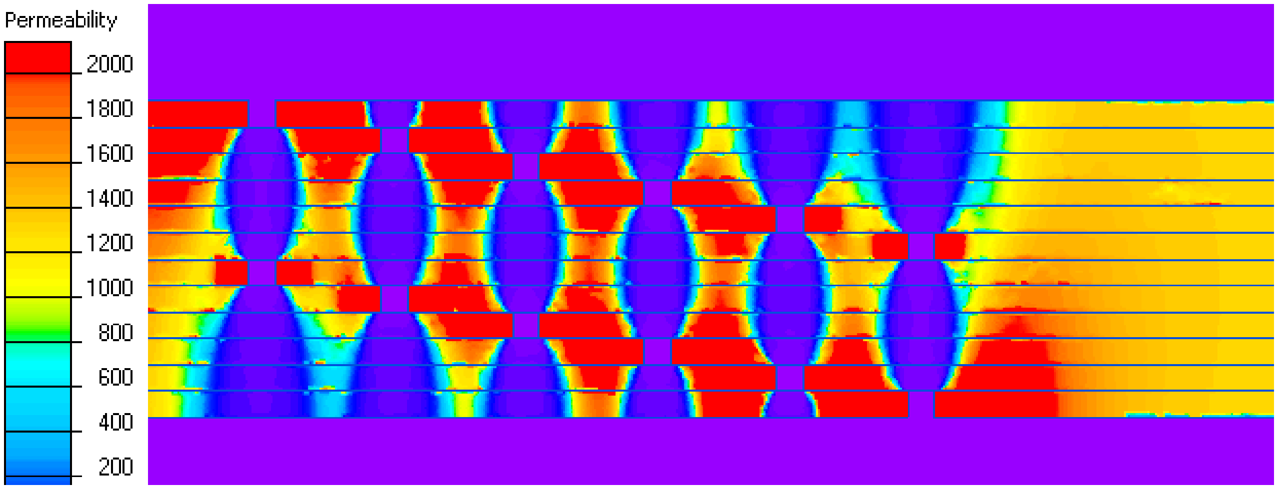
Task:

Obtain the magnetic field distribution in the core and surrounding air. Locate the saturated core areas

Step lap joint



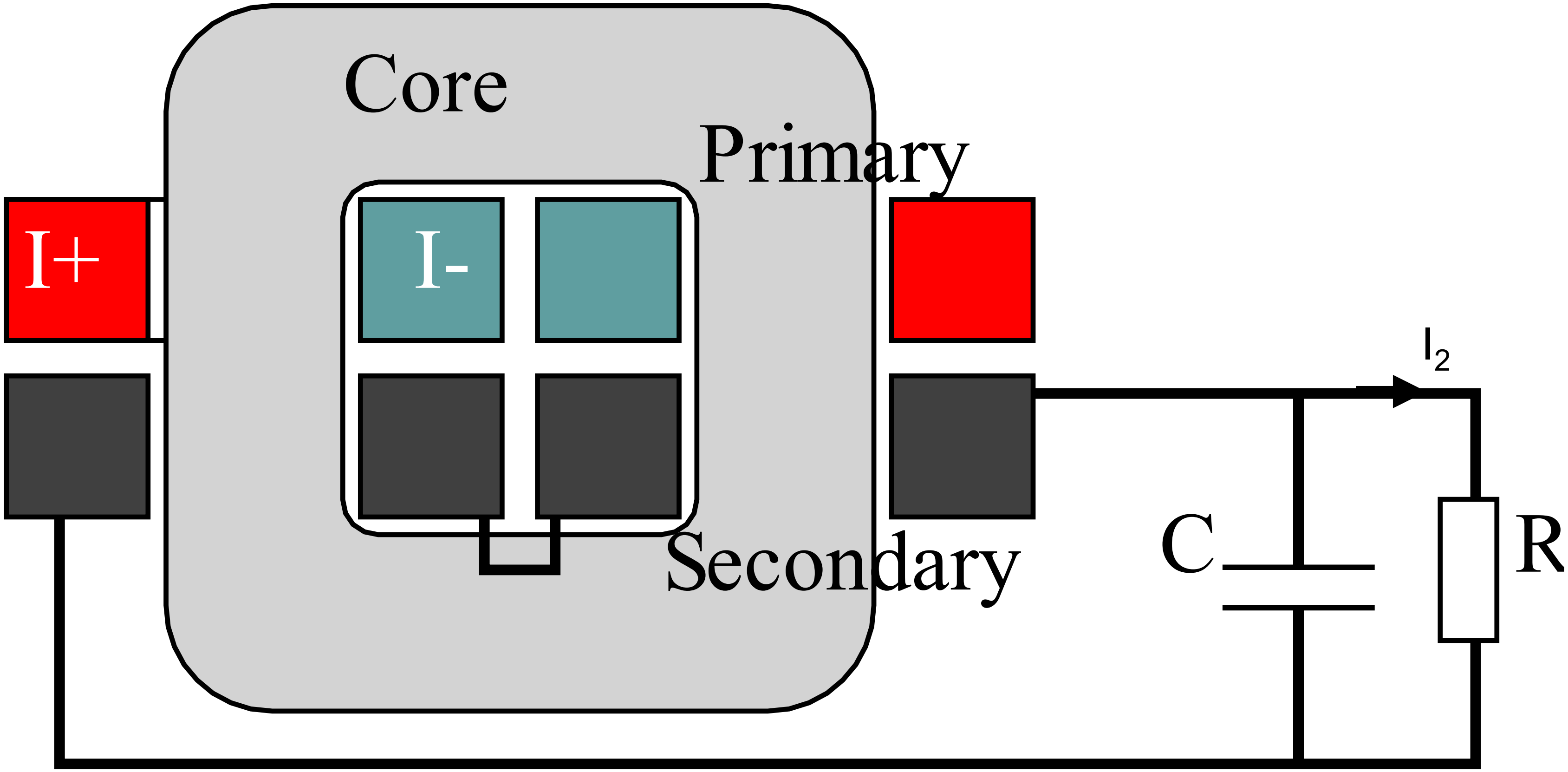
Flux density in the core



Relative magnetic permeability

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

Welding transformer output power



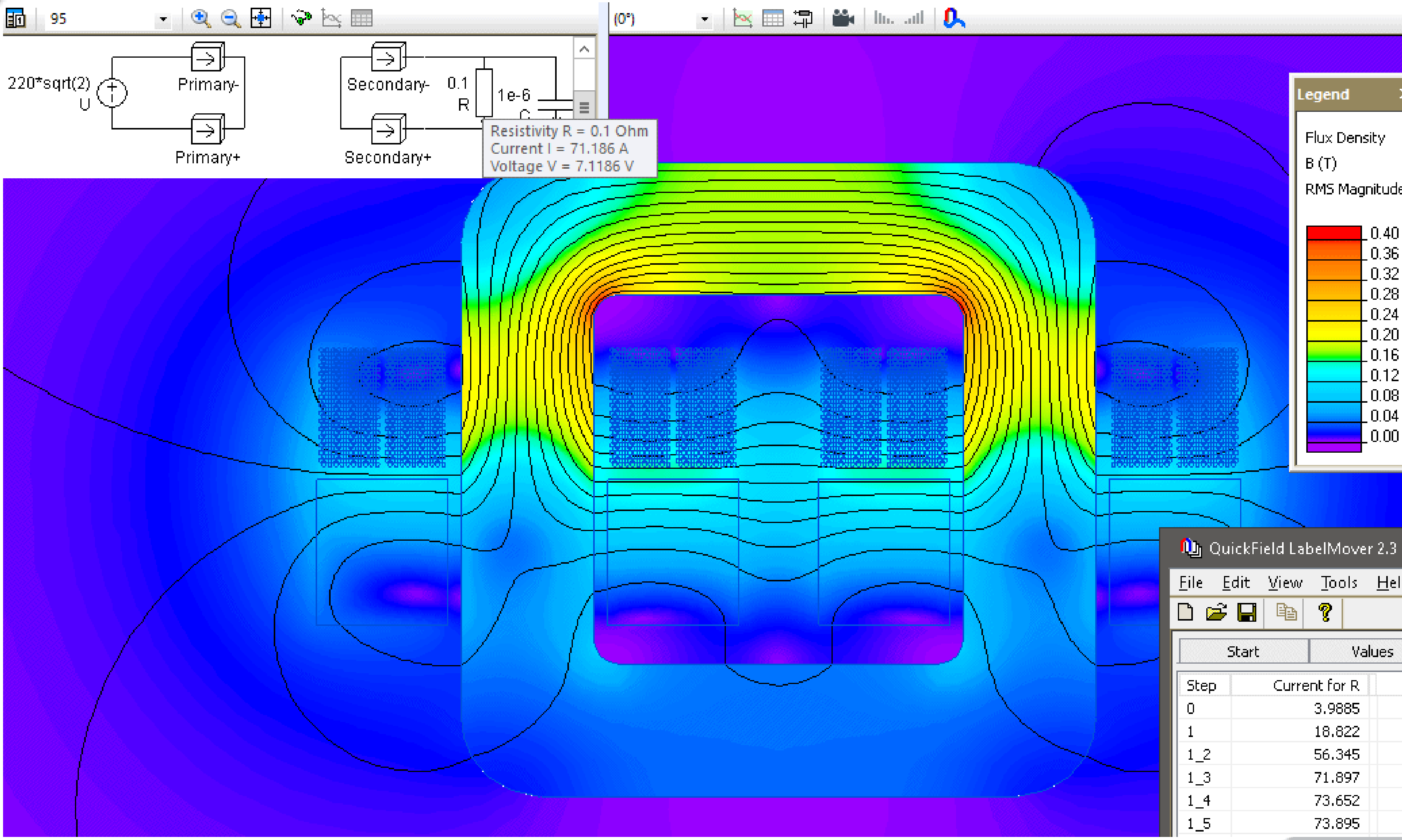
Problem specification:

C = 1 pF, R = 0..10 Ohm
Frequency *f* = 60 Hz
Primary voltage = 220 V

Task:

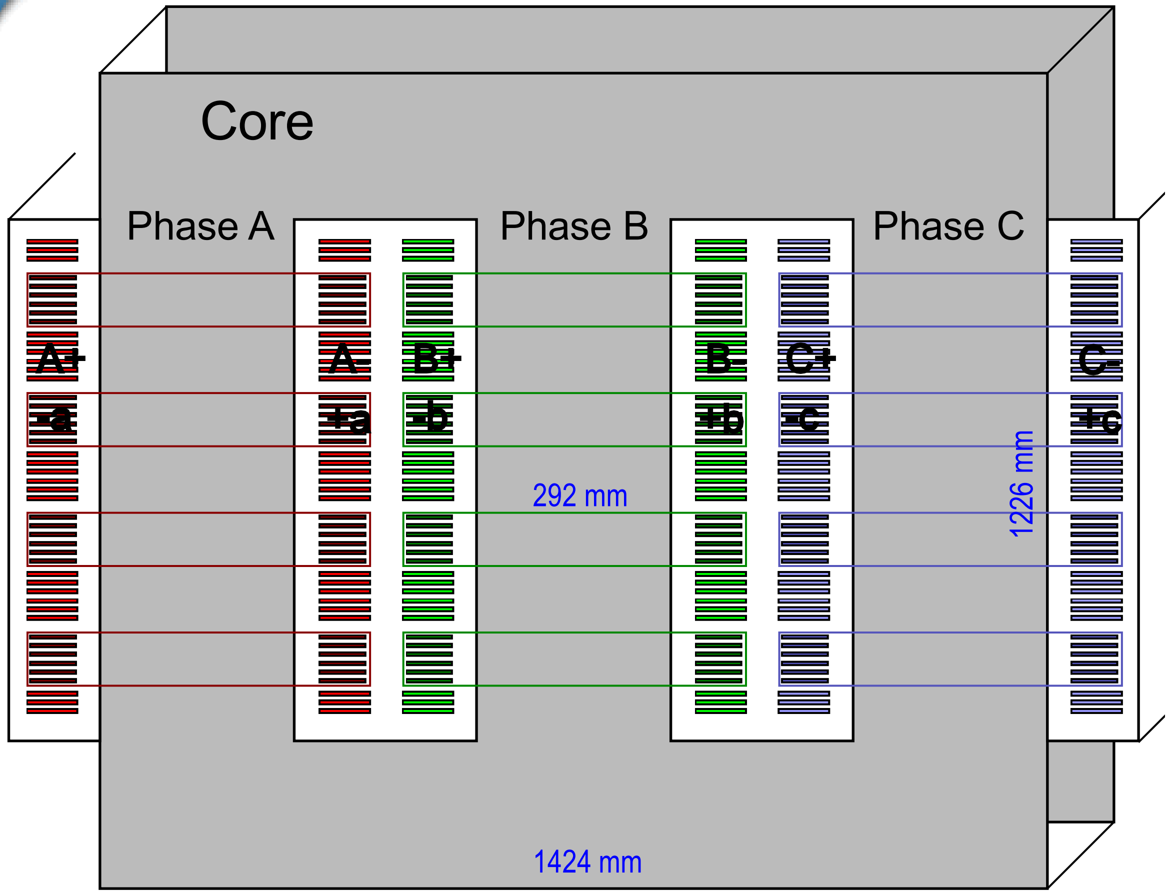
Calculate the output voltage $U_2(I_2)$

Welding transformer output power



https://quickfield.com/advanced/circuit2.htm

Furnace transformer short circuit



Problem specification:

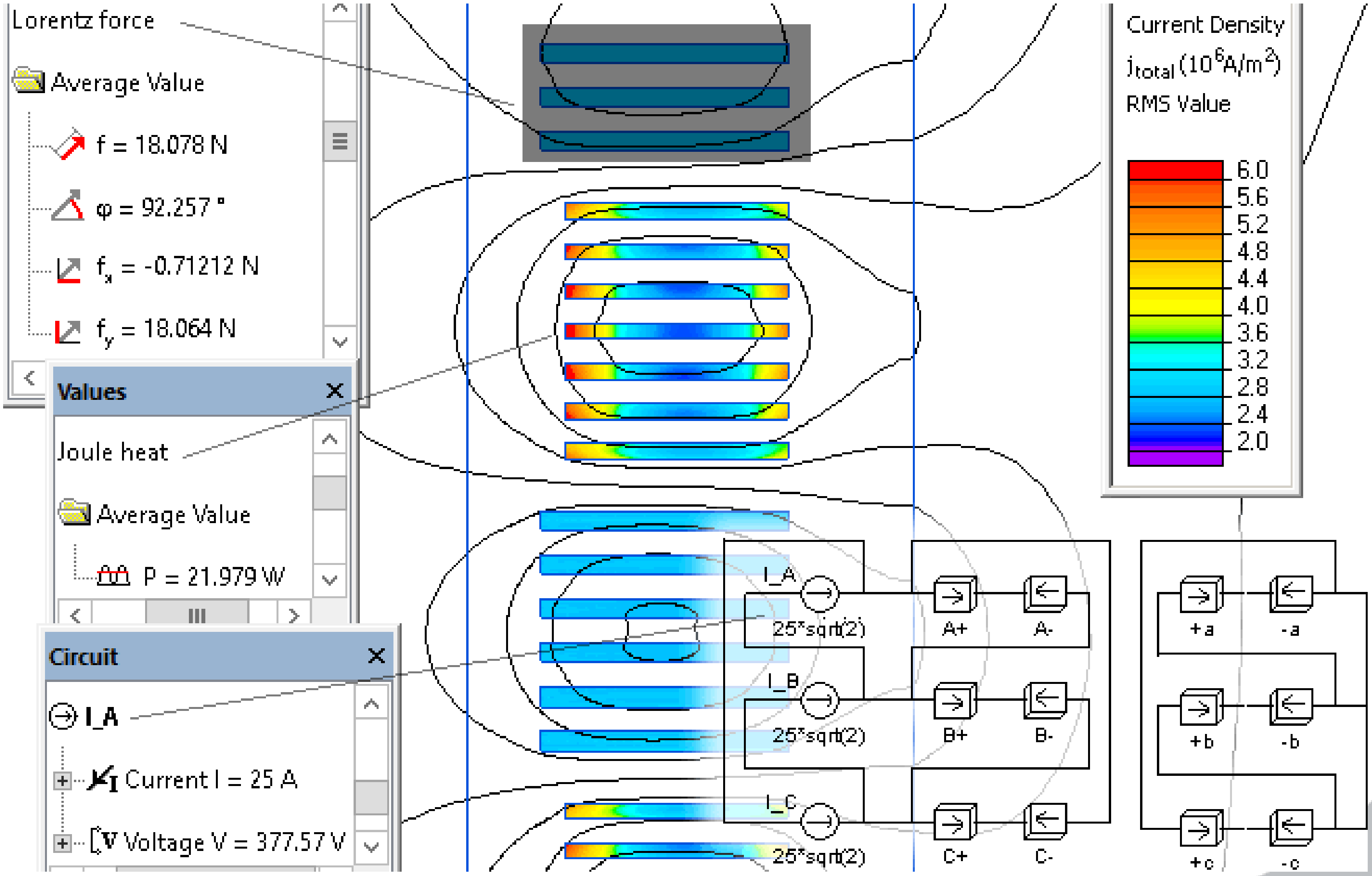
Primary current I = 25 A
Frequency f = 50 Hz
Winding connection scheme Δ-Δ

Task:

Estimate the transformer short circuit voltage, axial forces in the windings, build the stray fluxes field picture.

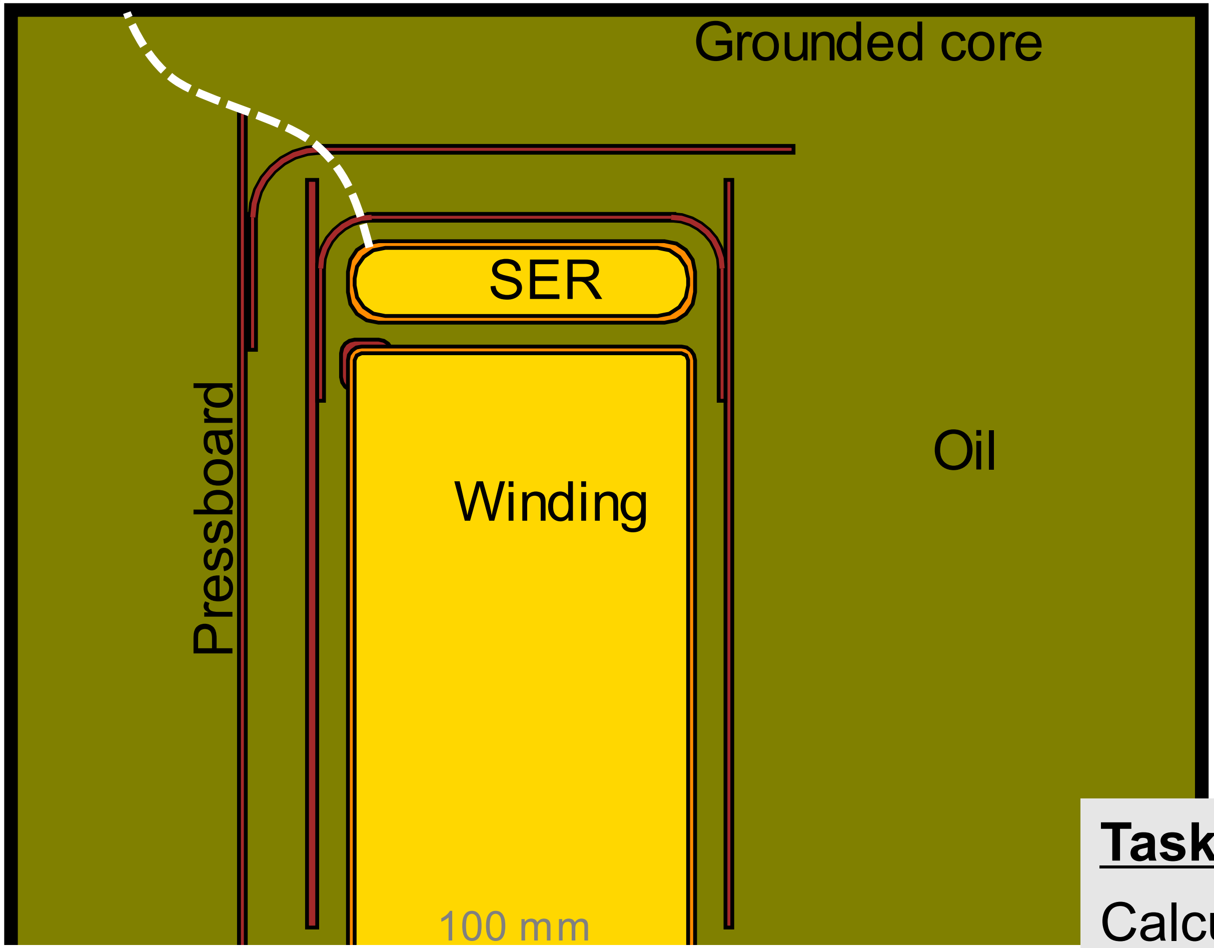
https://quickfield.com/advanced/transformer_stray_flux.htm

Furnace transformer short circuit



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

End-winding insulation



Problem specification:

Relative permittivity of

oil	2.2
paper	3.5
pressboard	4.5

HV = 200 kV

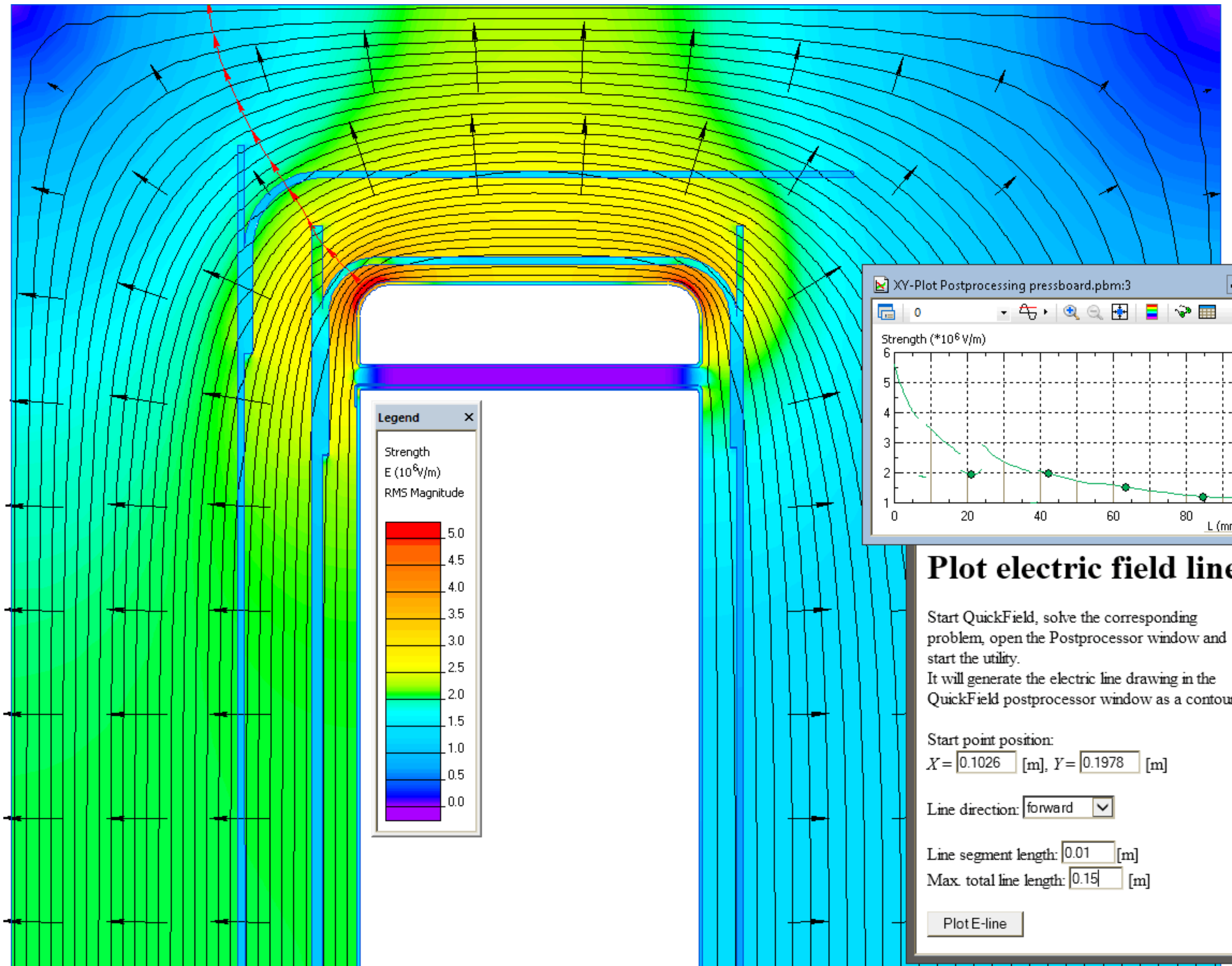
AC frequency = 50 Hz

Task:

Calculate electric field stress distribution in the oil gaps.

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

End-winding insulation



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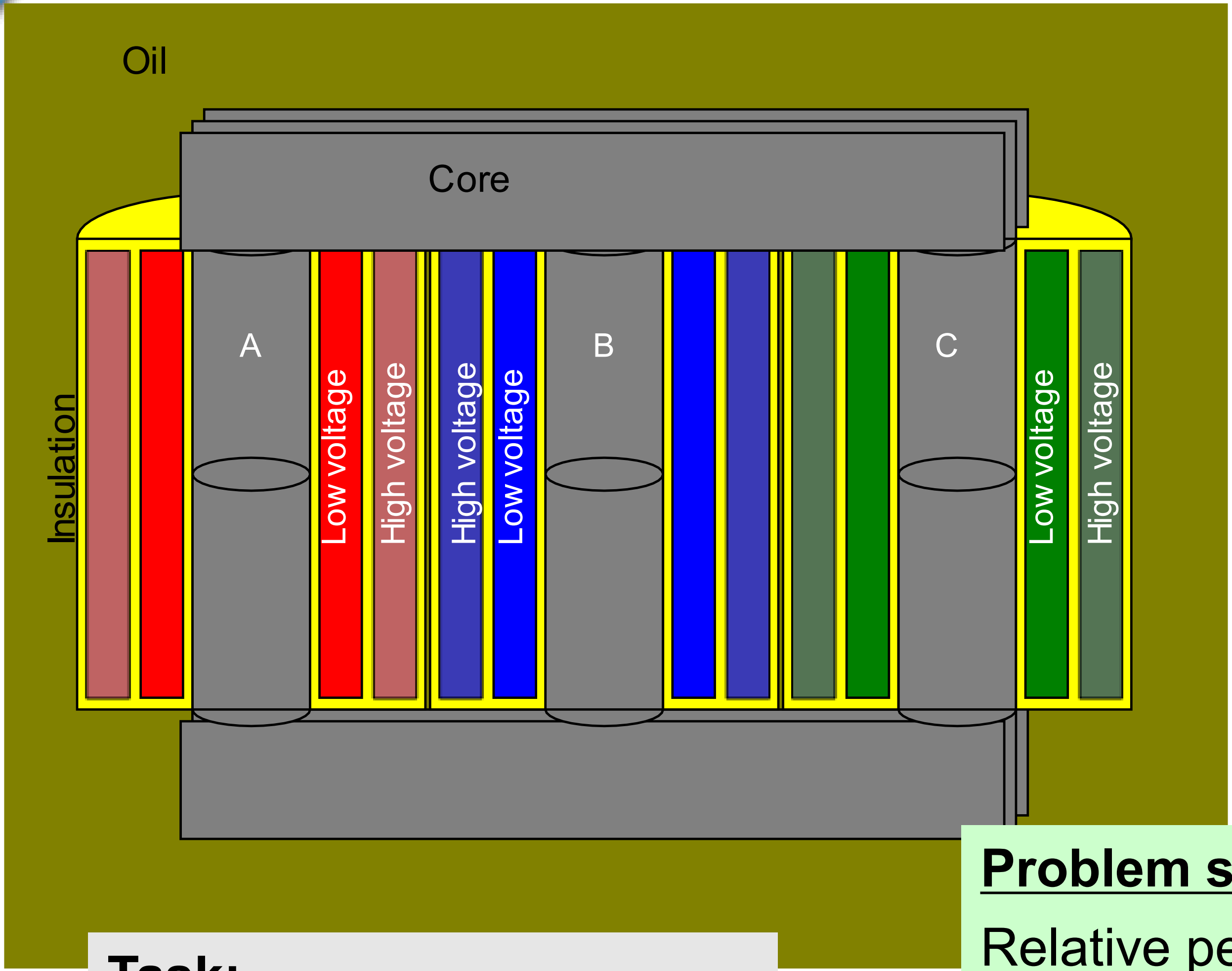
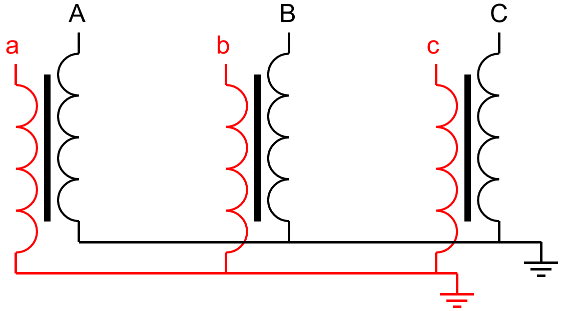
Oil electric stress 3D





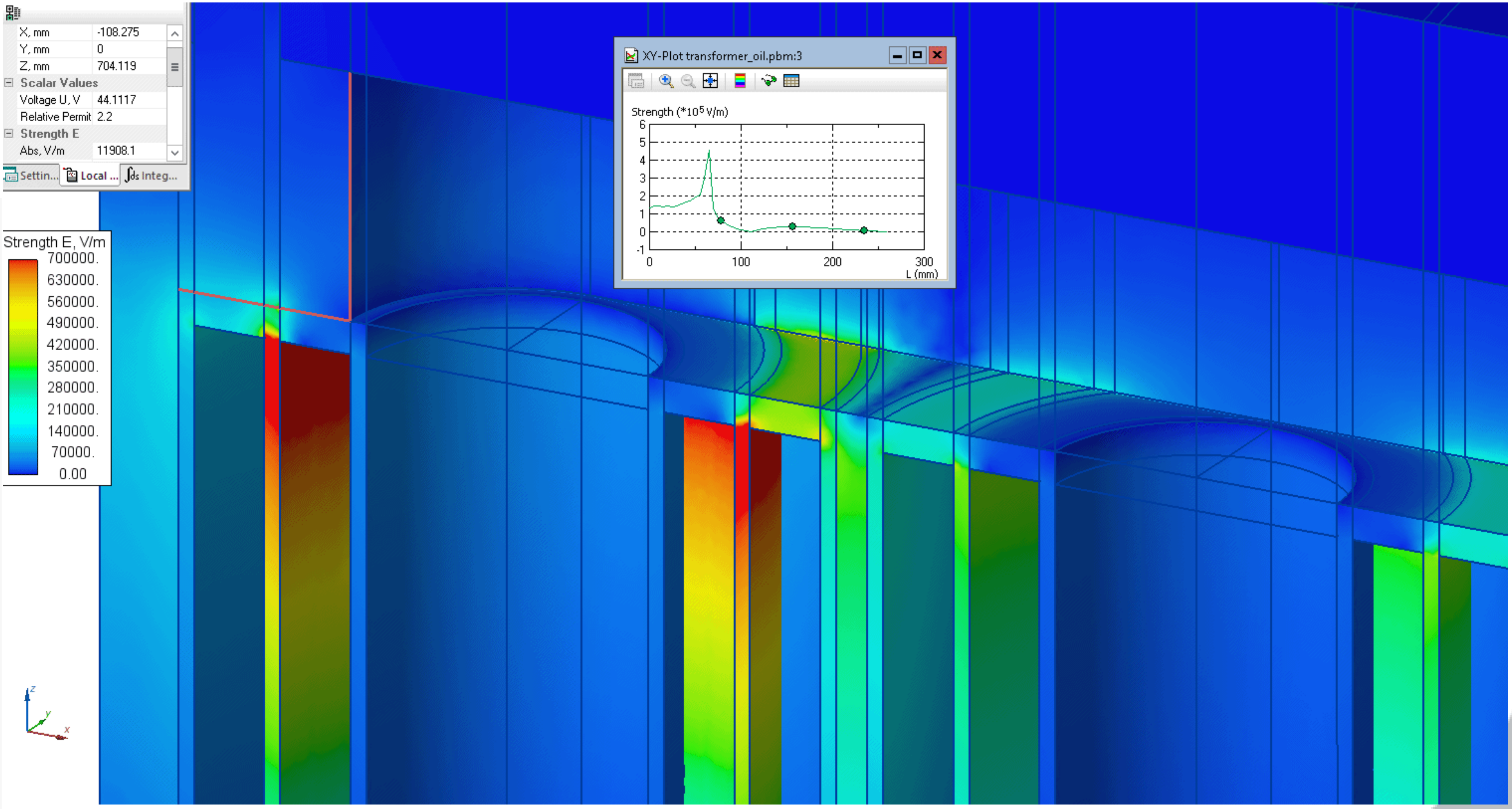
Task:

Calculate the electric field stress distribution in the oil.

Problem specification:

Relative permittivity:
oil - 2.2, pressboard - 4.5
High voltage (phase) V = 6 kV
Low voltage (phase) V = 0.4 kV

Oil electric stress 3D



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