Multiphysics simulation with QuickField

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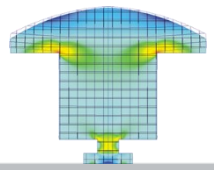
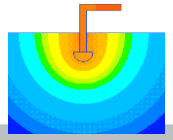
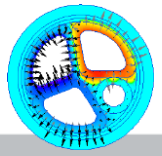
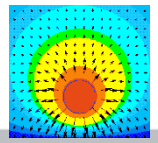
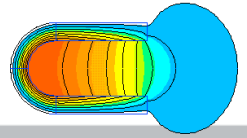
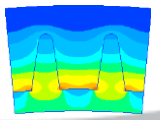
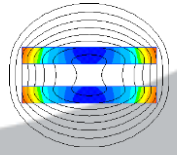
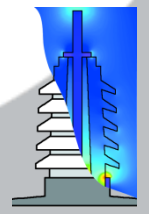
QuickField Analysis Options

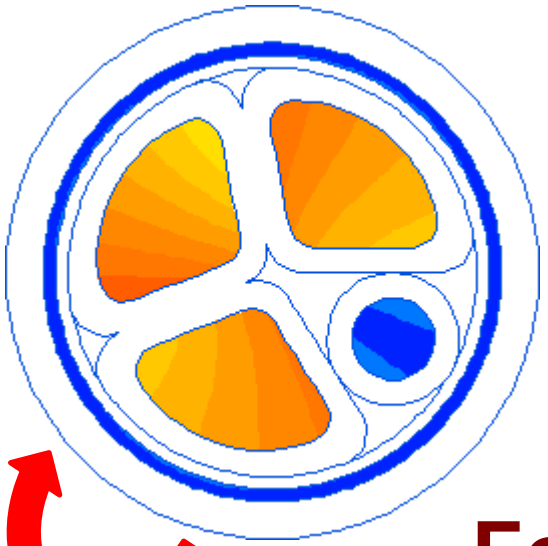
Magnetic analysis suite	
Magnetic Problems	Magnetostatics
	AC Magnetics
	Transient Magnetic
Electric analysis suite	
Electric Problems	Electrostatics (2D,3D) and DC Conduction (2D,3D)
	AC Conduction
	Transient Electric field
Thermostructural analysis suite	
Thermal and mechanical problems	Steady-State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

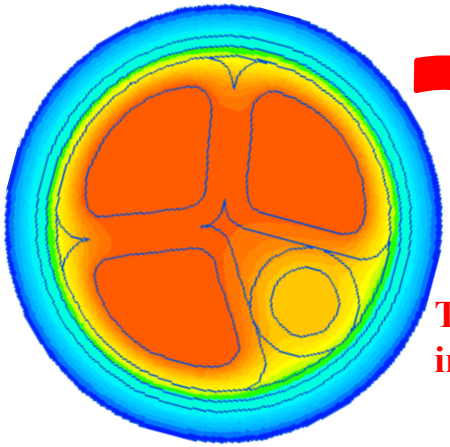
MultiPhysics (2D)

Temperature field

Electromagnetic fields



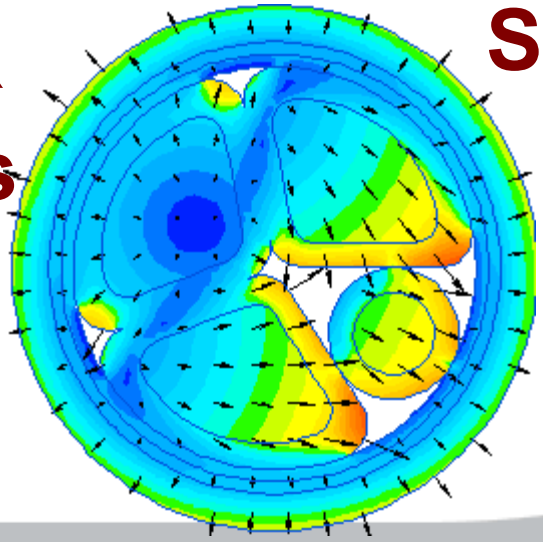
Losses



Temperature field import

Thermal Stresses

Forces



Magnetic state import

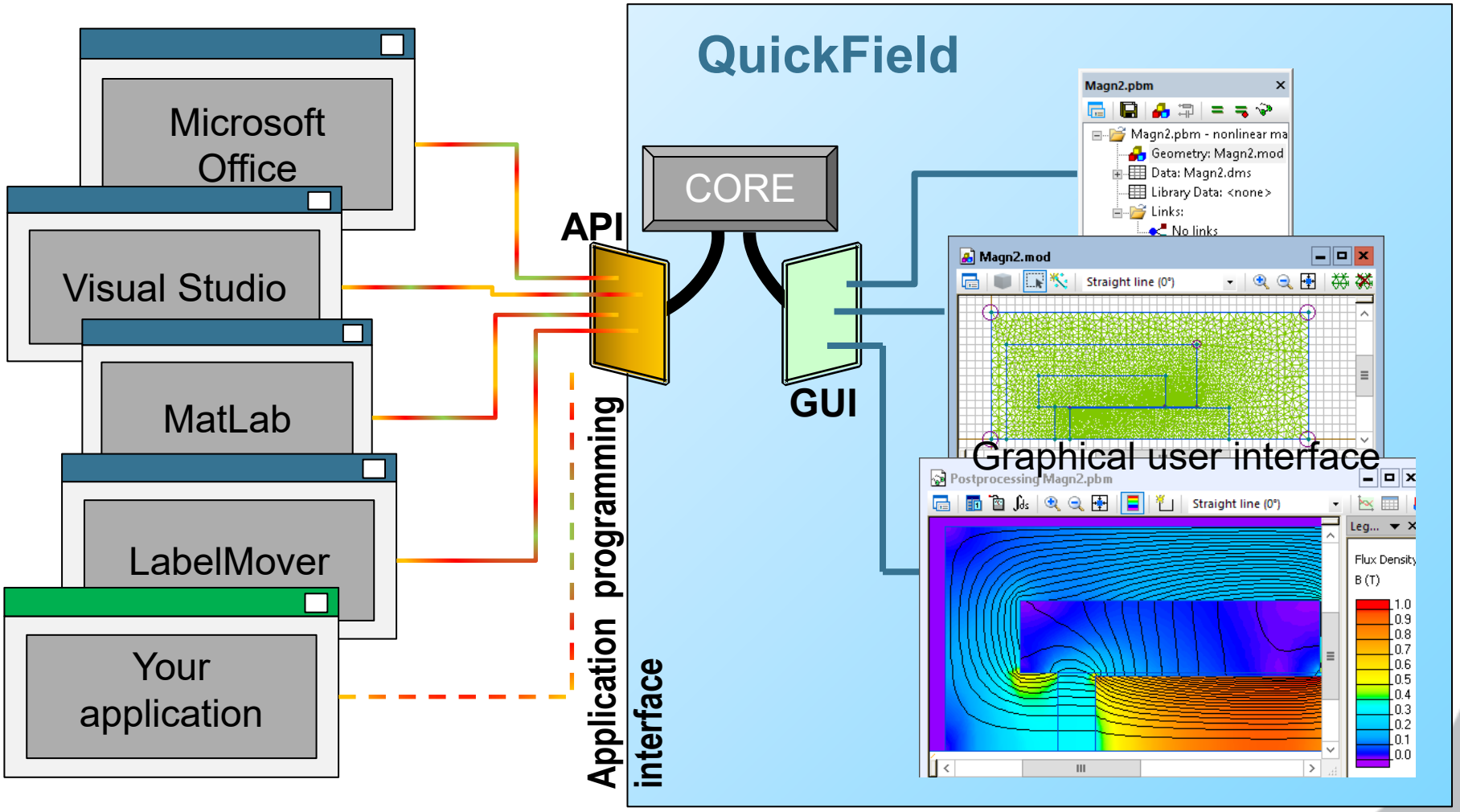
Stresses & Deformations

MultiPhysics (2D)

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

Source \ Destination	DC magnetics	AC magnetics	Transient magnetics	Static heat transfer	Transient heat transfer	Stress Analysis
DC magnetics	Permeability	Permeability	Initial conditions			Force [N]
AC magnetics				Joule heat [W]	Joule heat [W]	Force [N]
Transient magnetics			Initial conditions	Joule heat [W]	Joule heat [W]	Force [N]
Electrostatics						Force [N]
DC conduction				Joule heat [W]	Joule heat [W]	
AC conduction				Joule heat [W]	Joule heat [W]	Force [N]
Transient electric						
Static heat transfer		Temperature [T]			Initial conditions	Temperature [T]
Transient heat transfer		Temperature [T]			Initial conditions	Temperature [T]
Stress Analysis						

Open object interface



QuickField Difference

Multiphysics simulation with QuickField

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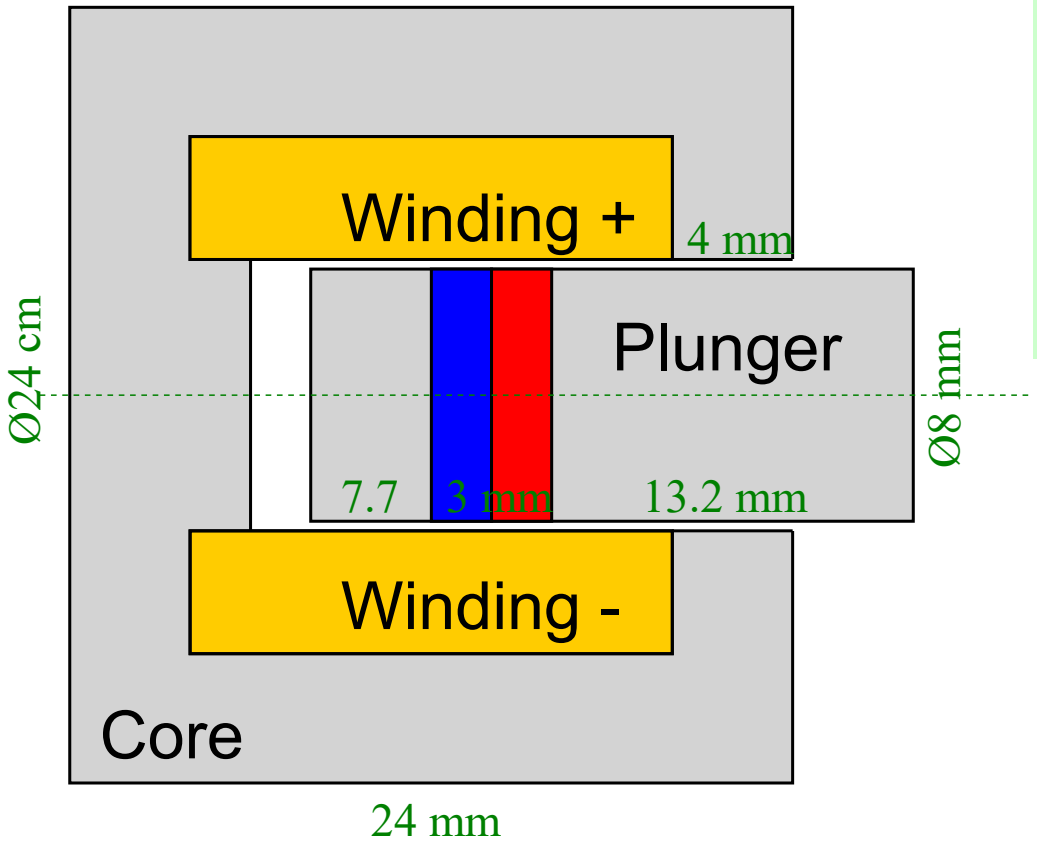
1. Biased relay force
2. Inductor inrush current stress
3. Cylindrical fuse operation time

Biased relay force



Problem specification:

Voltage applied V+ = 3.5 V
Number of turns = 312
Permanent magnet coercive force H_c = 500 kA/m

Task:

Determine the pulling force vs. time dependency after switching the relay on.

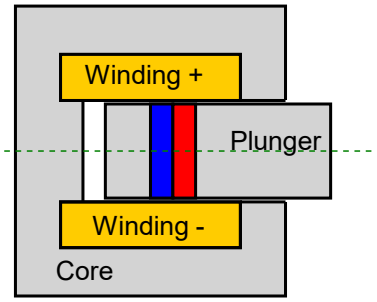
Initial magnetic field distribution

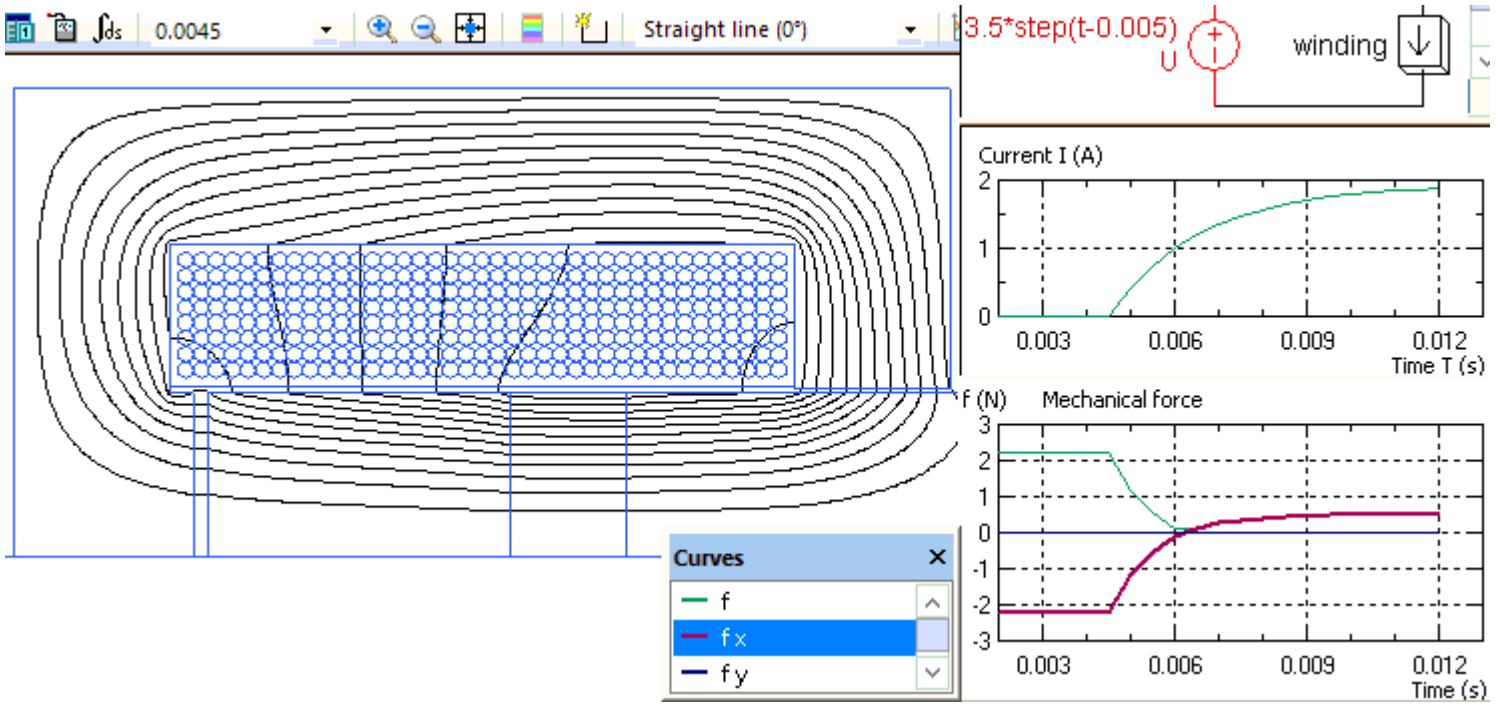
DC Magnetics > Transient Magnetics

Biased relay force

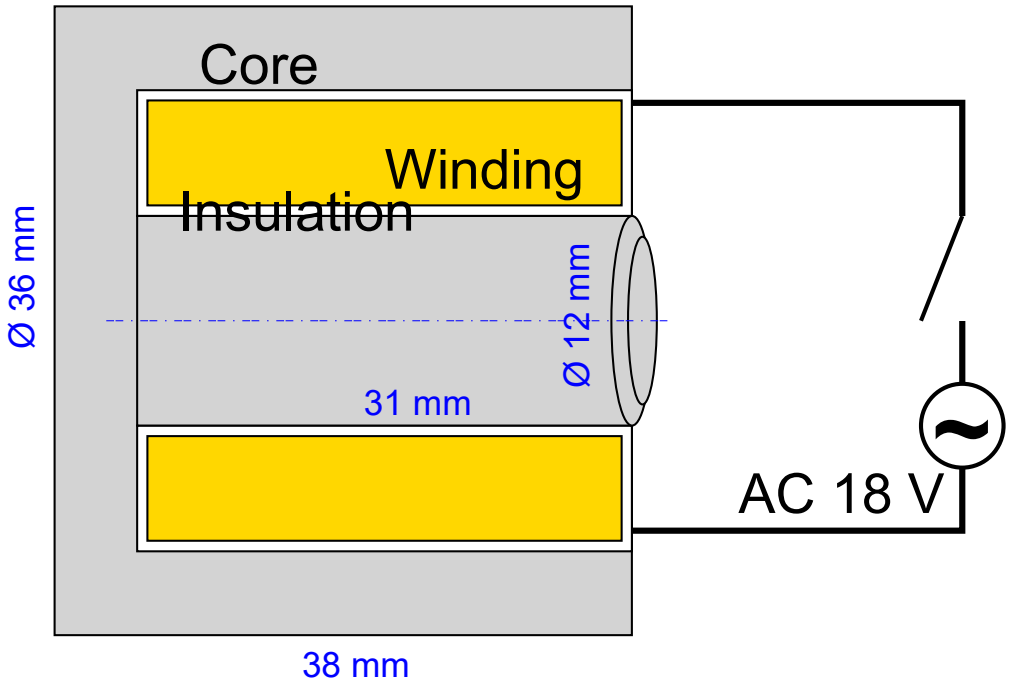
Initial magnetic field distribution

DC Magnetics > Transient Magnetics





Inductor inrush current stress



Problem specification:

Voltage applied V~ = 18 V
Number of turns = 600
Frequency *f* = 60 Hz.

Task:

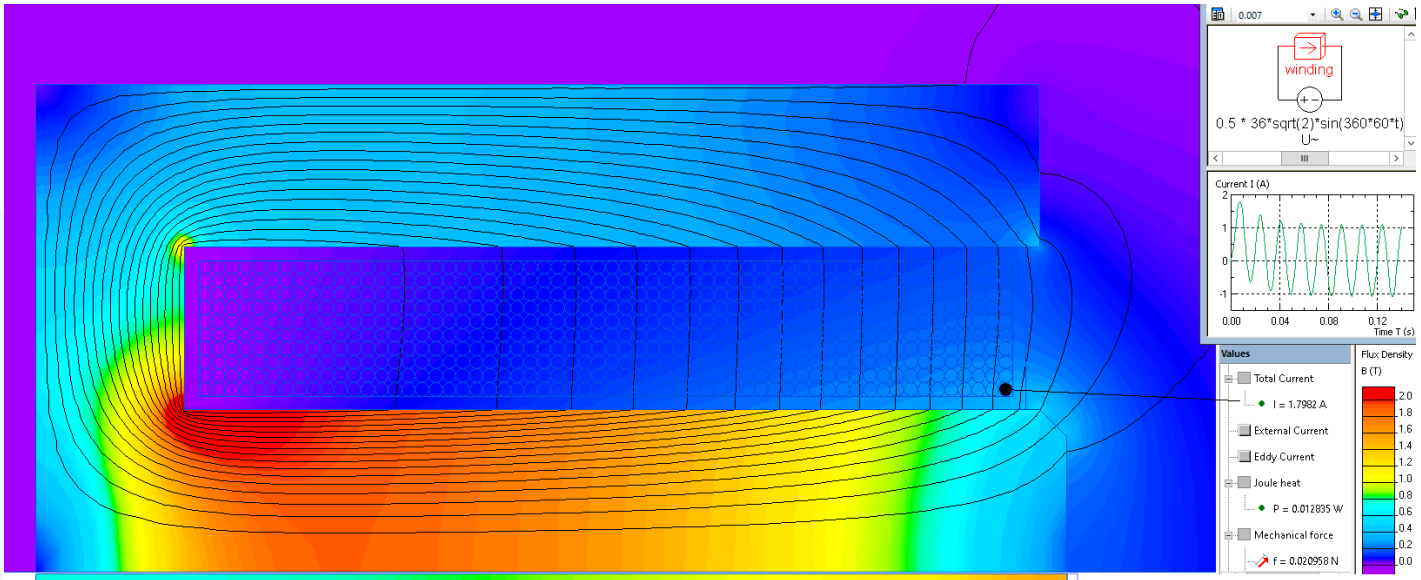
Calculate the peak current value and mechanical stress in the inductor winding.

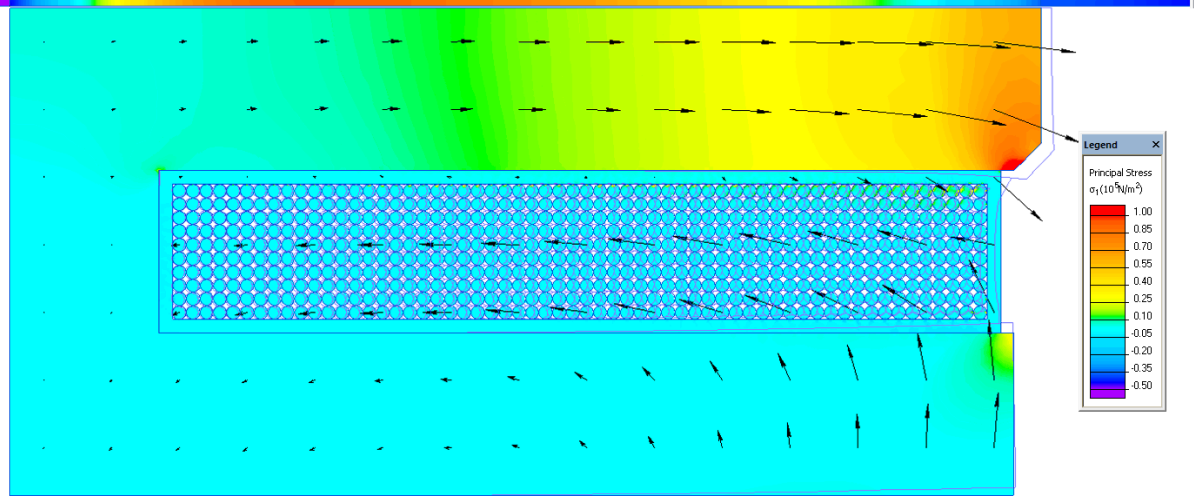
Magnetic force

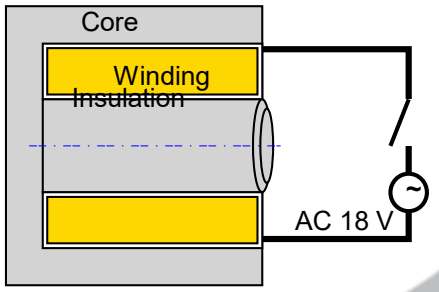
Transient Magnetics > Stress analysis

Inductor inrush current stress

Magnetic force: Transient Magnetics > Stress analysis

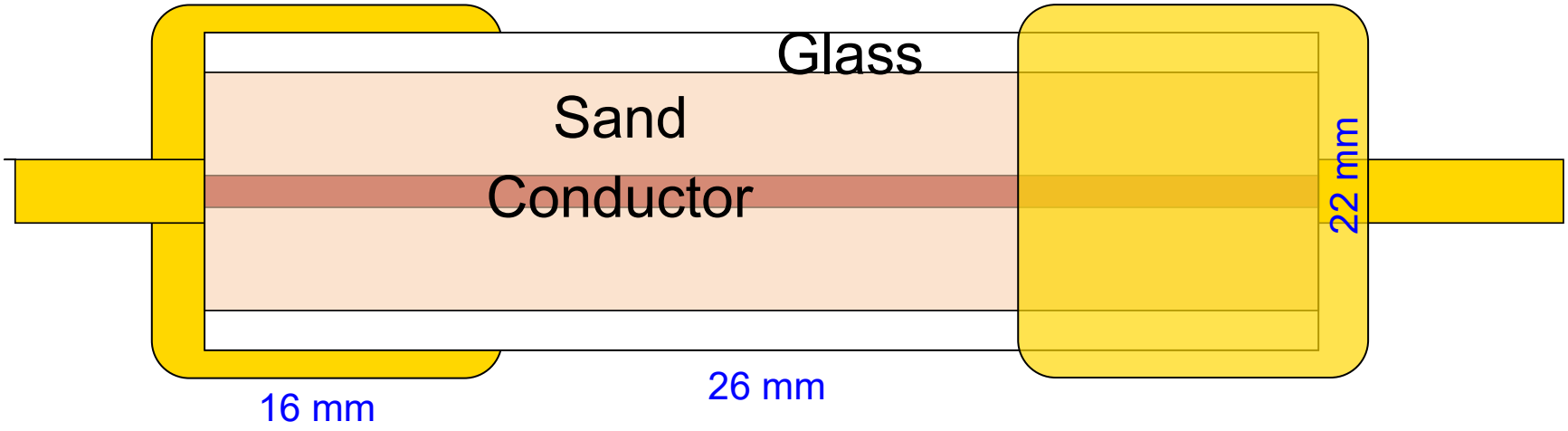






www.quickfield.com/advanced/inductor_inrush_current.htm

Cylindrical fuse operation time



Problem specification:

Rated current I_0 = 5 A
Fault current I = 20 A
Ambient air temperature T_0 = 20 °C
Conductor melting point T = 240 °C
Quartz sand thermal conductivity
λ = 0.3 W/m-K.

Joule heat:

DC Conduction >
Transient Heat-transfer

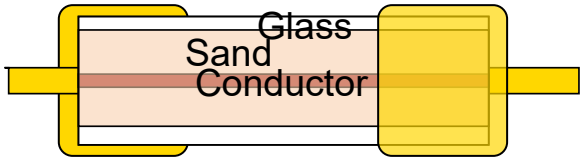
Task:

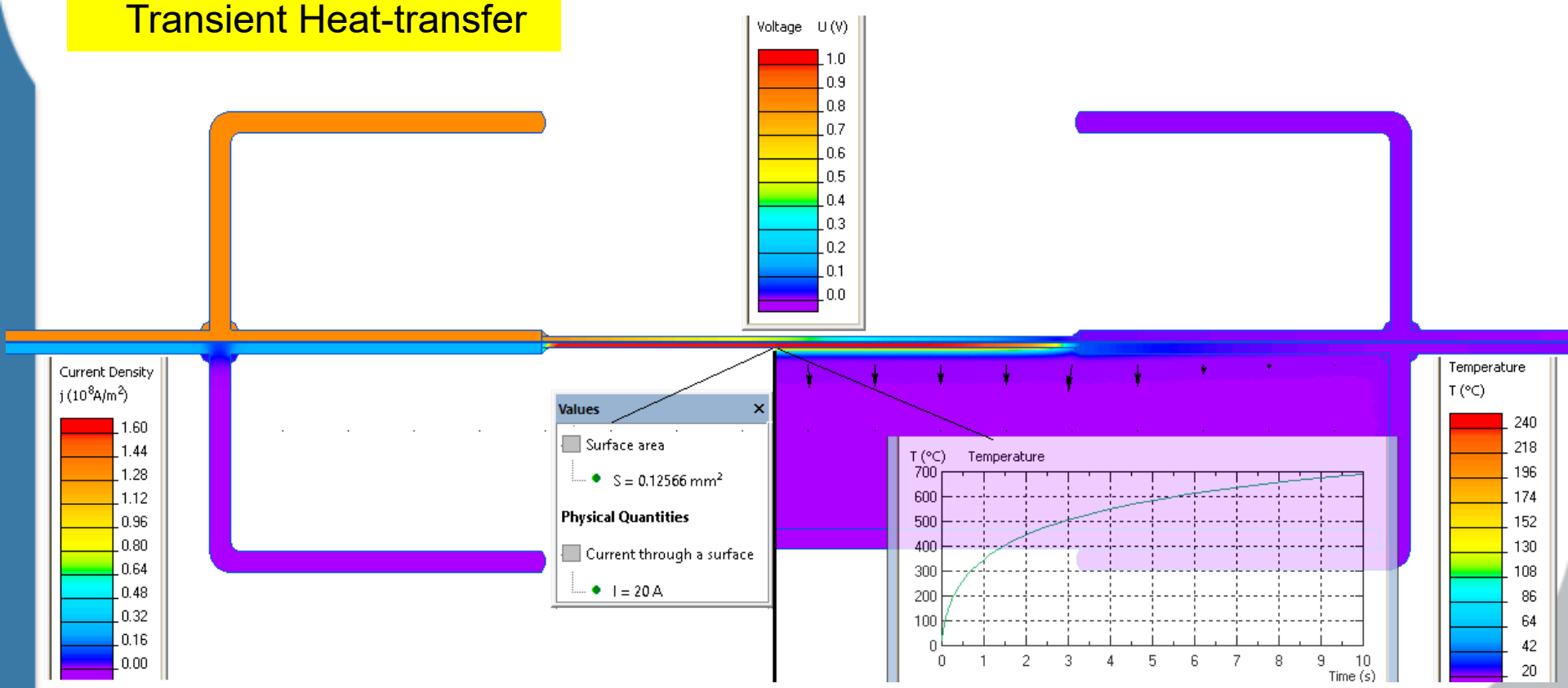
Determine the cylindrical fuse operating time

Cylindrical fuse operation time

Joule heat:

DC Conduction >
Transient Heat-transfer





www.quickfield.com/advanced/cylindrical_fuse.htm