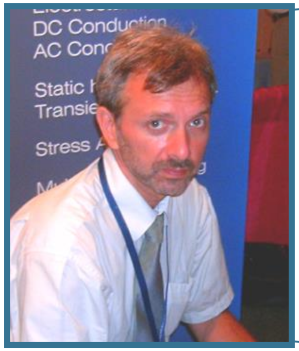
Stress analysis with QuickField

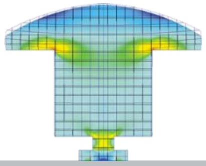
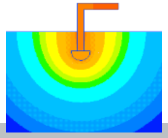
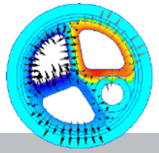
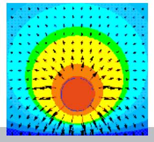
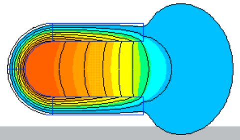
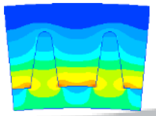
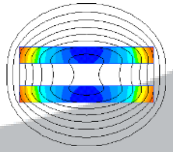
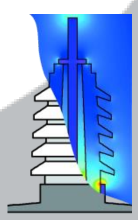


Vladimir Podnos,
Director of Marketing and Support,
Tera Analysis Ltd.
Introduction

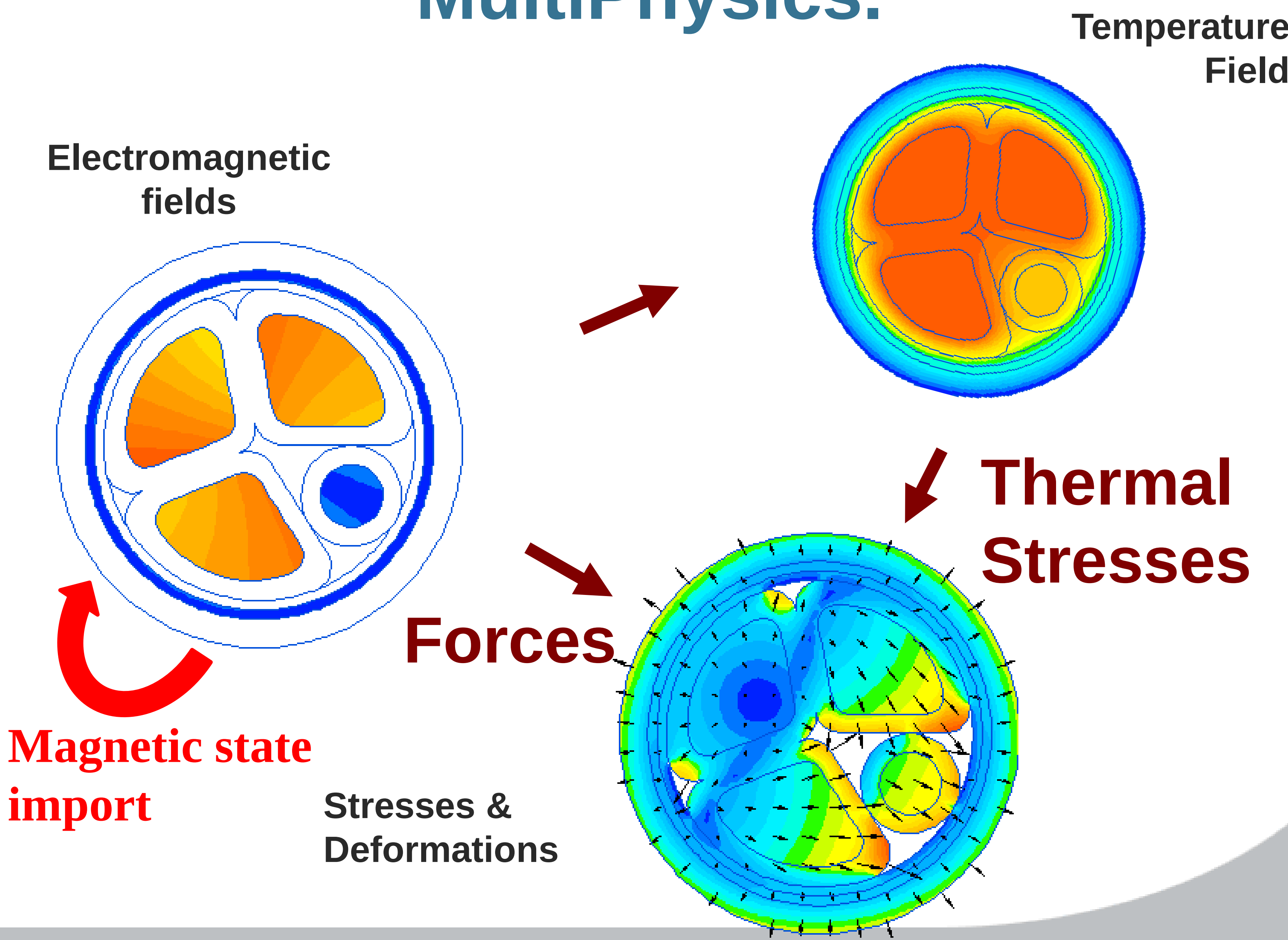
Alexander Lyubimtsev
Support Engineer,
Tera Analysis Ltd.
QuicField live demonstration

QuickField Analysis Options

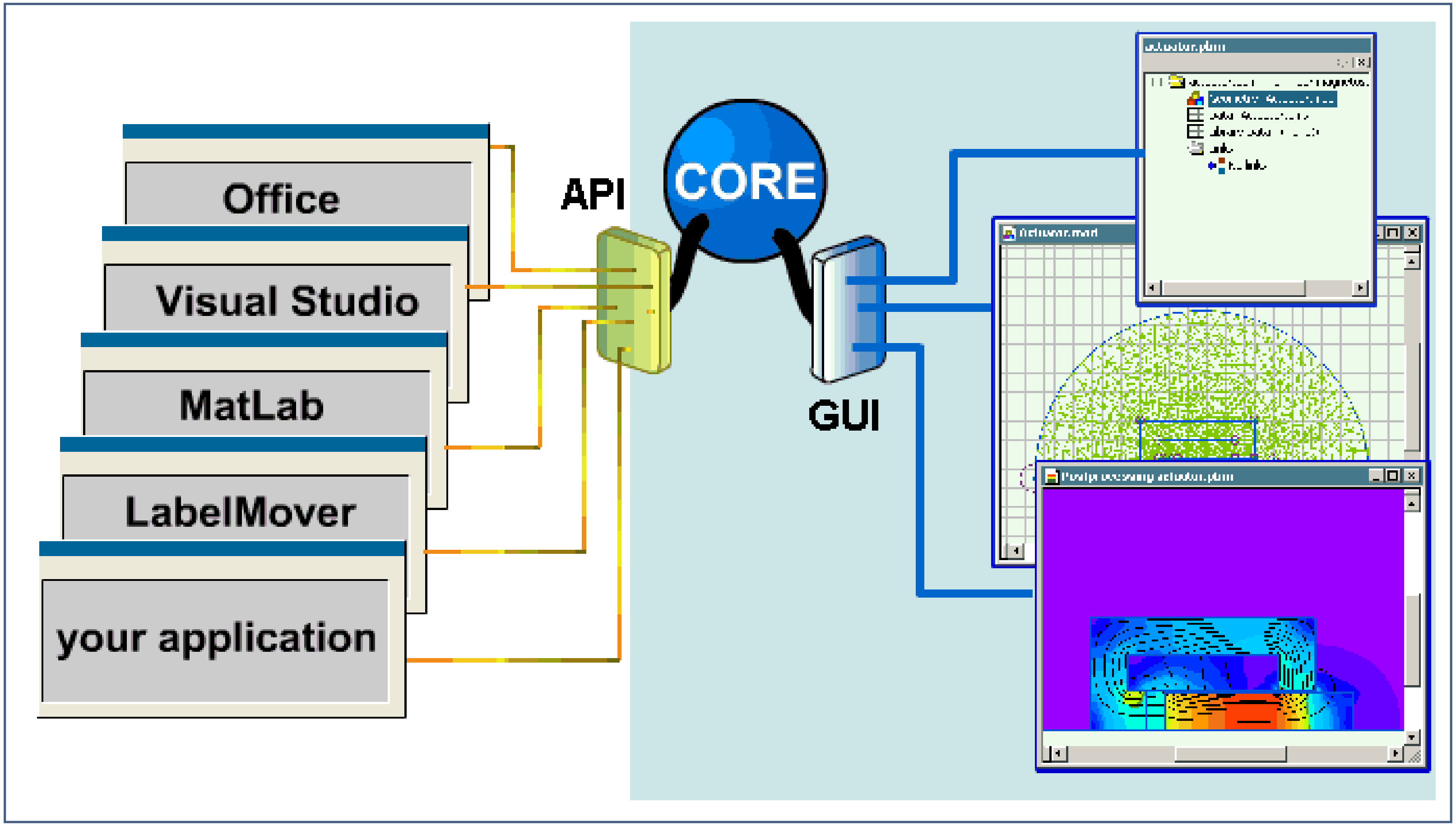
Magnetic analysis suite	
Magnetic Problems	Magnetostatics
	AC Magnetics
	Transient Magnetic
Electric analysis suite	
Electric Problems	Electrostatics and DC Conduction
	AC Conduction
	Transient Electric field
Thermostructural analysis suite	
Thermal and mechanical problems	Steady-State Heat transfer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

MultiPhysics.



Open object interface



QuickField Difference

Field simulation software

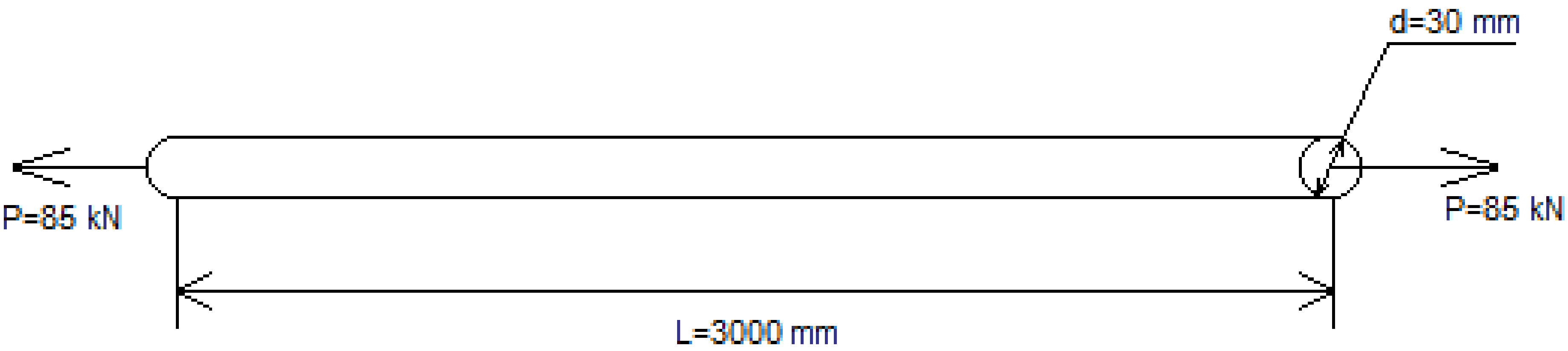
www.QuickField.com

No training required

Strtess analysis with QuickField

1. Cylindrical rod
2. Perforated plate.
3. Stress distribution in a long solenoid.
4. Pipe subject to temperature and pressure.
5. Bimetallic thermal control (parametric with LabelMover).
6. Winding force
7. Stress deformed shape.

Cylindrical rod



Problem specification:

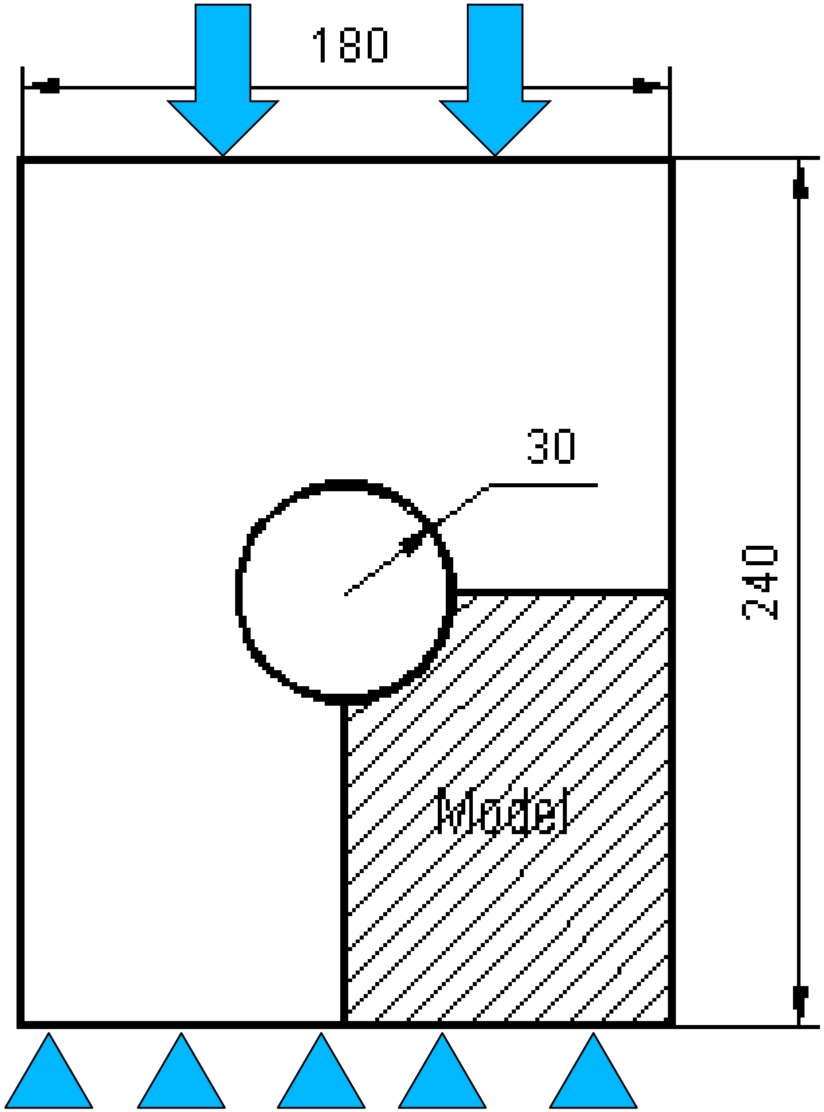
Young's modulus E = 70 GPa;
Poisson's coefficient v = 1/3

Task:

Calculate the rod elongation

http://quickfield.com/advanced/cylindrical_bar.htm

Perforated plate



Problem specification:

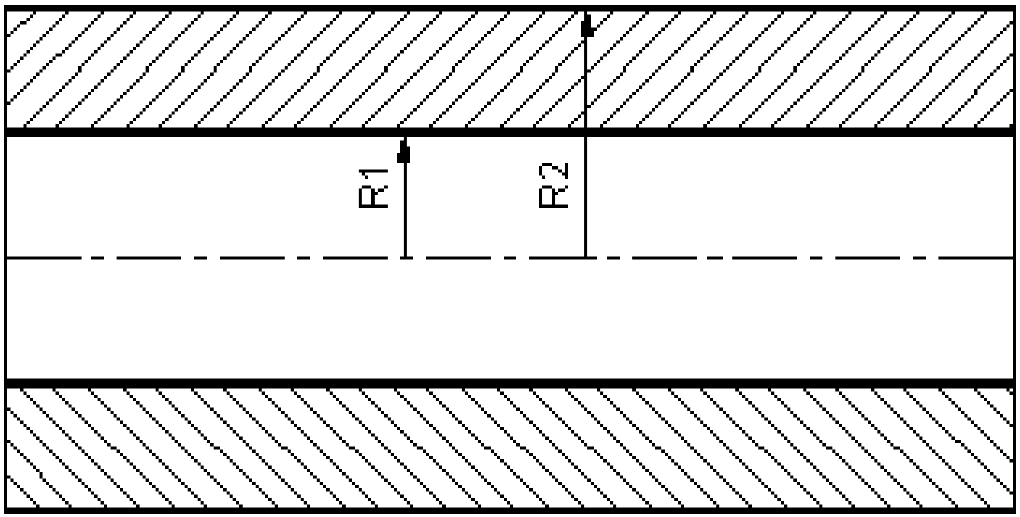
Young's modulus E = 20.7 GPa;
Poisson's coefficient ν = 0.3

Task:

Calculate the stress concentration factor

http://quickfield.com/advanced/stress1.htm

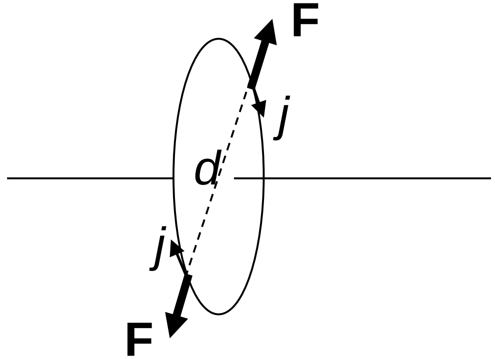
Stress distribution in a long solenoid



R1 = 1 cm, *R2* = 2 cm

Magnetic force

$F = k * j^2 / d$



Problem specification:

Current density
$j = 0.1\ A/mm^2$;

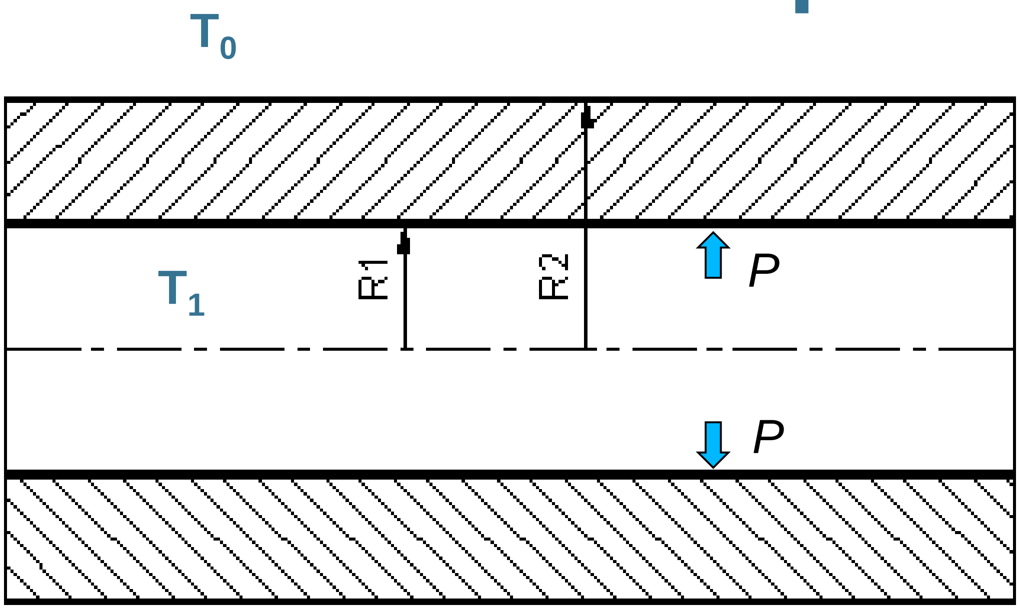
Young's modulus
$E = 107.5$ GPa;
Poisson's ratio $\nu = 0.33$.

Task:

Calculate the stress distribution in the solenoid

http://quickfield.com/advanced/coupl1.htm

Pipe subject to temperature and pressure



R1 = 1 cm, *R2* = 2 cm

Problem specification:

Inner surface T_1 = 100 C;
Outer surface T_o = 0 C;
Internal pressure P = 1 MPa;

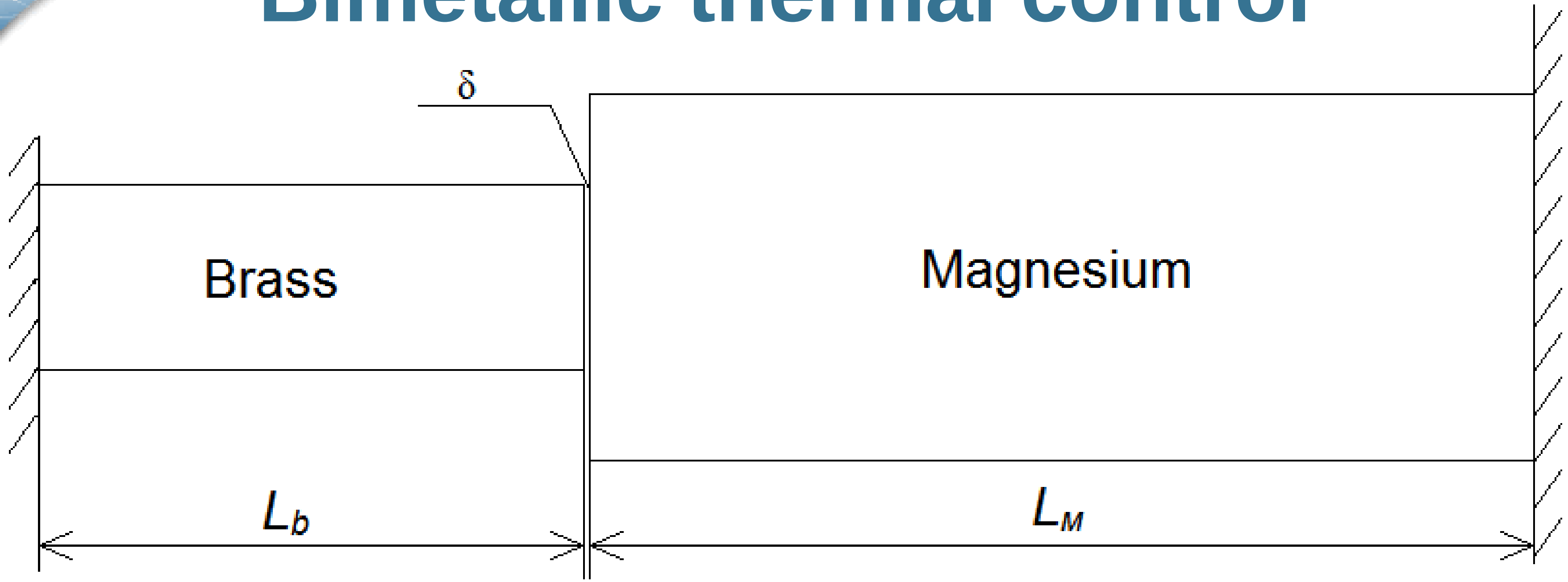
Coefficient of thermal expansion $\alpha = 10^{-6}$ 1/K;
Young's modulus E = 300 GPa;
Poisson's ratio ν = 0.3.

Task:

Calculate the stress distribution in the pipe

http://quickfield.com/advanced/coupl2.htm

Bimetallic thermal control



L_b = 0.75"; L_m = 1.3"; δ = 0.005"

Task:

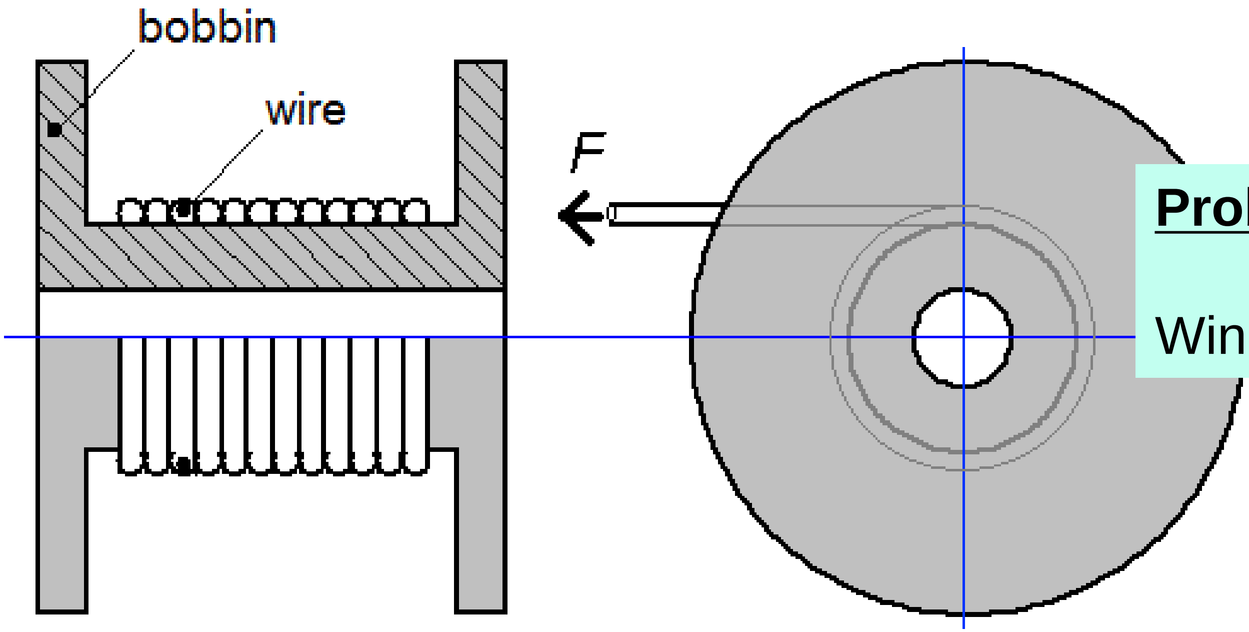
Calculate the temperature increase at which the two bars come into contact.

Problem specification:

Brass bar
$E_b = 15 \cdot 10^6$ psi (103 GPa)
$\alpha_b = 10 \cdot 10^{-6}$ 1/F ($18 \cdot 10^{-6}$ 1/K)
Magnesium bar
$E_m = 6.5 \cdot 10^6$ psi (44.8 GPa)
$\alpha_m = 14.5 \cdot 10^{-6}$ 1/F ($26.1 \cdot 10^{-6}$ 1/K)

http://quickfield.com/advanced/thermal_control.htm

Winding force



Problem specification:

Winding force, F = 50 N.

Task:

Calculate the bobbin deformation

Hooke's law elongation

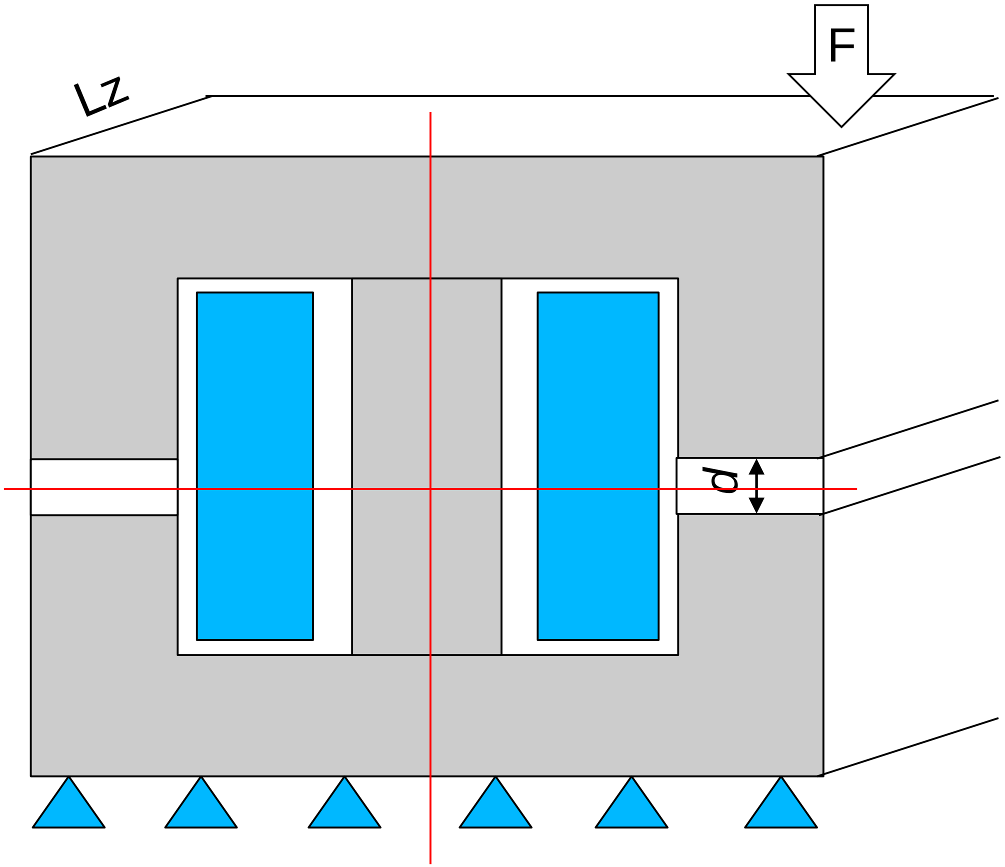
$dL/L_0 = F / (E \cdot A_w)$

Thermal expansion

$dL/L_0 = \alpha \cdot dT$

http://quickfield.com/advanced/winding_force.htm

Stress deformed shape



Problem specification:

Steel core Young's modulus
E = 200 GPa,
Air gap *d* = 1 mm
Force applied *F*= 2 kN
Model depth L_z = 80 mm

Calculate:

1. Core displacement.
2. Magnetic flux distribution

http://quickfield.com/stress_deform.htm