

Induction Heat Treating

October 2013

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Create, Design, Engineer!

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Our Problem

A Load
A Coil
A Power Supply
A Process
An Environment
All included in a power distribution system.

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Our Problem

Electrical,
Magnetic,
Thermal,
Power Electronics,
Mechanical,
System,
...

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Modeling Induction Heating

We need:

- Precise Geometry
- Power Supply
- Process Description
- Materials

Material Characteristics

- Electro-Magnetic
- Thermal
- Cooling
- Nonlinear
- Curie Temperature

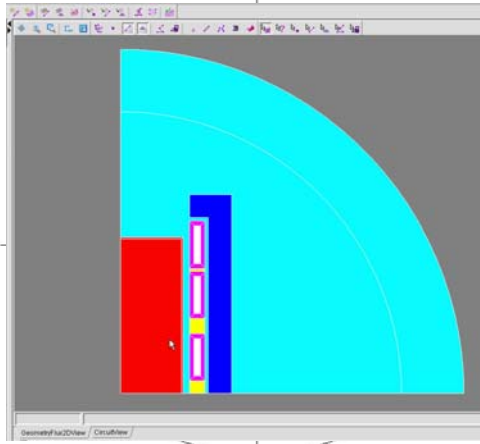
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Modeling Induction Heating

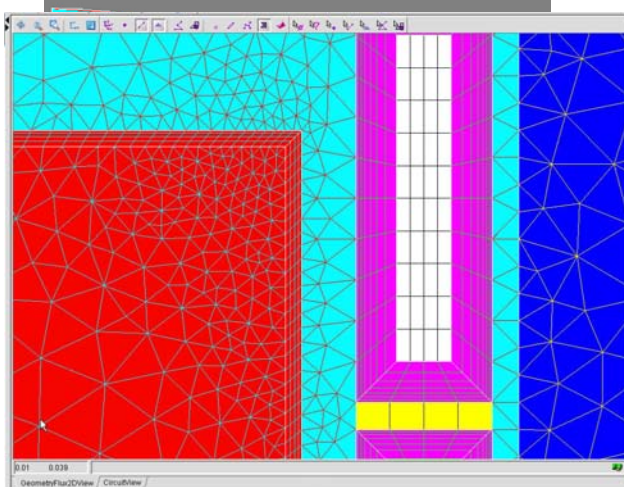
FEM Tool:
Geometry



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Modeling Induction Heating

FEM Tool:
Mesh

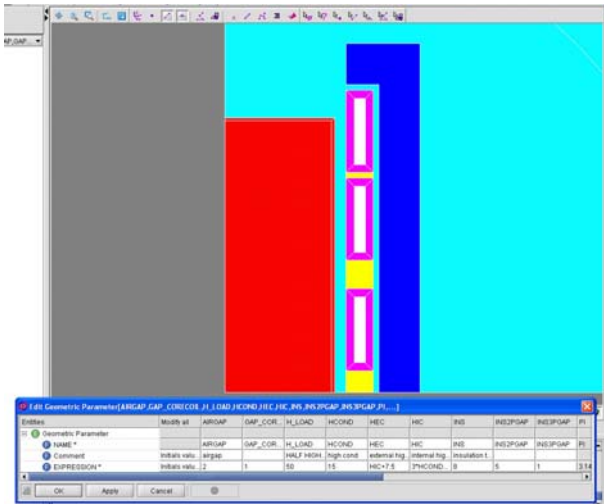


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Modeling Induction Heating

Parameters:

- Optimization
- Design
- Characterization



Entity	Modality as	ARIAP	SAP_COR	AL_LOAD	HCOND	HEC	HEC_HB	HEC_HB3	HEC3CAP	HEC3CAP_PL
1.00 Geometric Parameter										
NAME *		ARIAP	SAP_COR	AL_LOAD	HCOND	HEC	HEC_HB	HEC_HB3	HEC3CAP	HEC3CAP_PL
Comment		ARIAP			HALF HCON	High cond	external hq	internal hq	Insulation I	
EXPRESSION *				1	50	15	HEC+7.5	ZPWCCOND	3	5 1 3.14

OK Apply Cancel

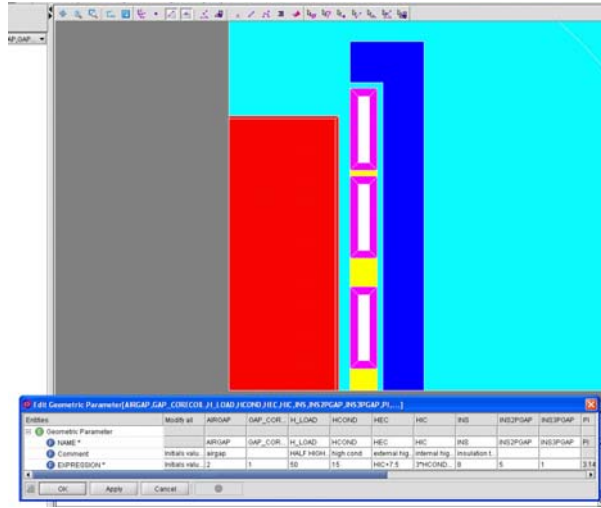
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- Optimization
- Design
- Characterization

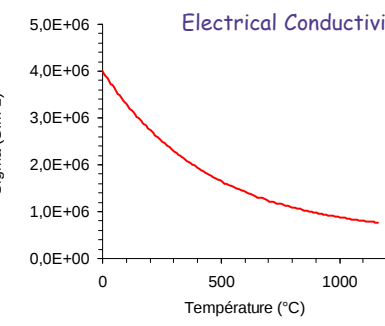


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Material properties

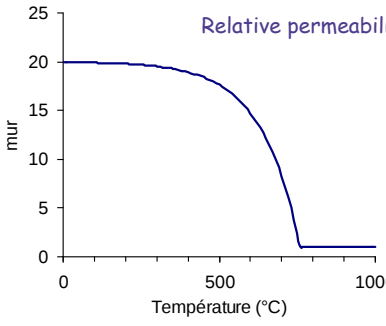


Electrical Conductivity



Temperature (°C)	Sigma (S.m-1)
0	4.0E+06
500	1.8E+06
1000	0.8E+06

Relative permeability

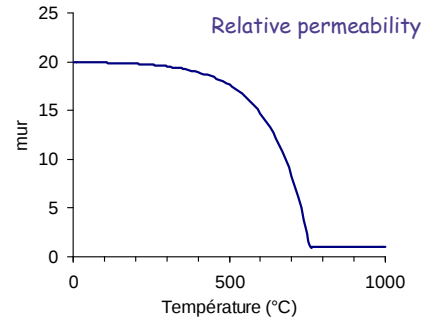


Temperature (°C)	mur
0	20
500	18
750	1
1000	1

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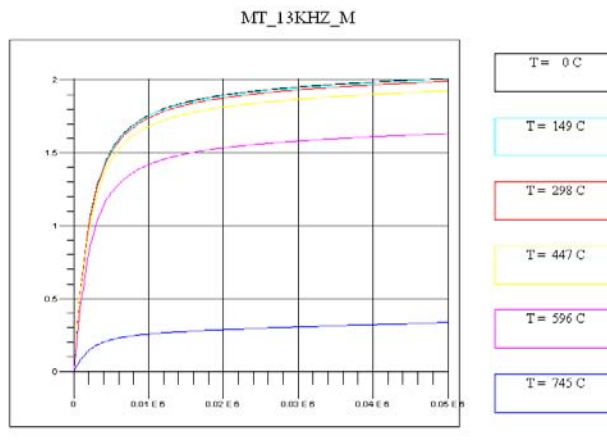


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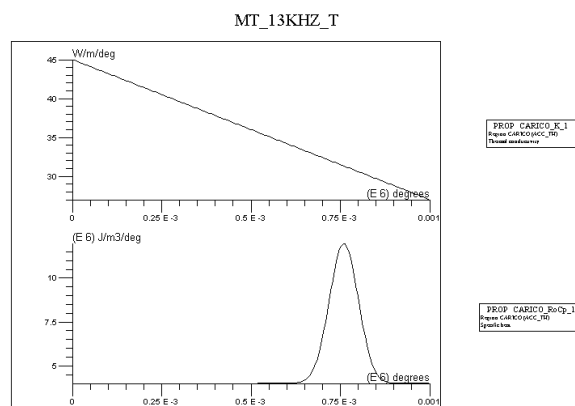


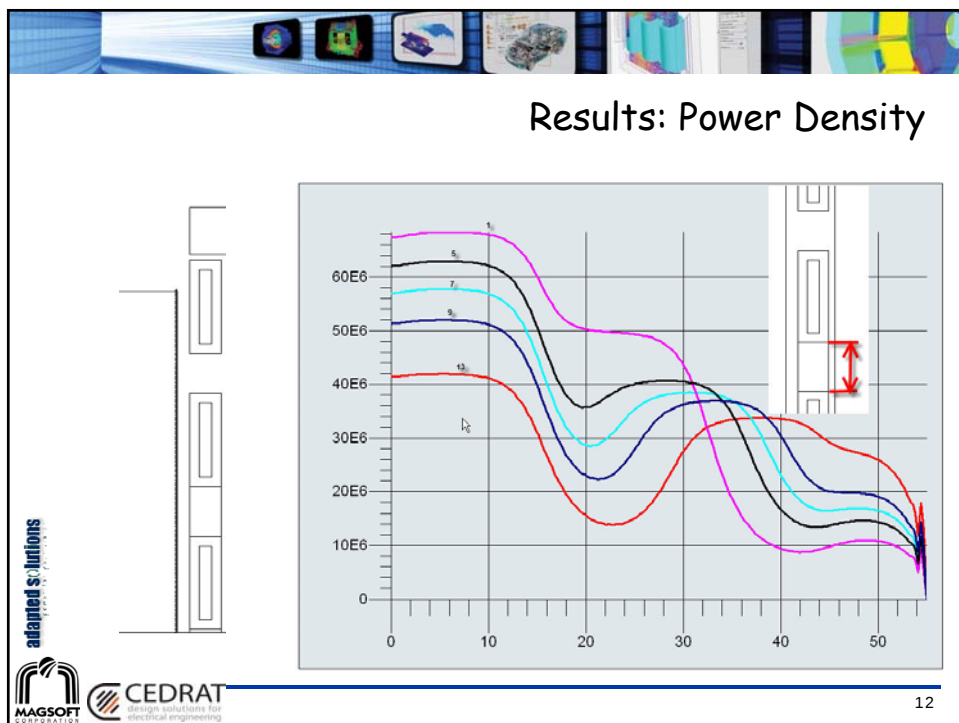
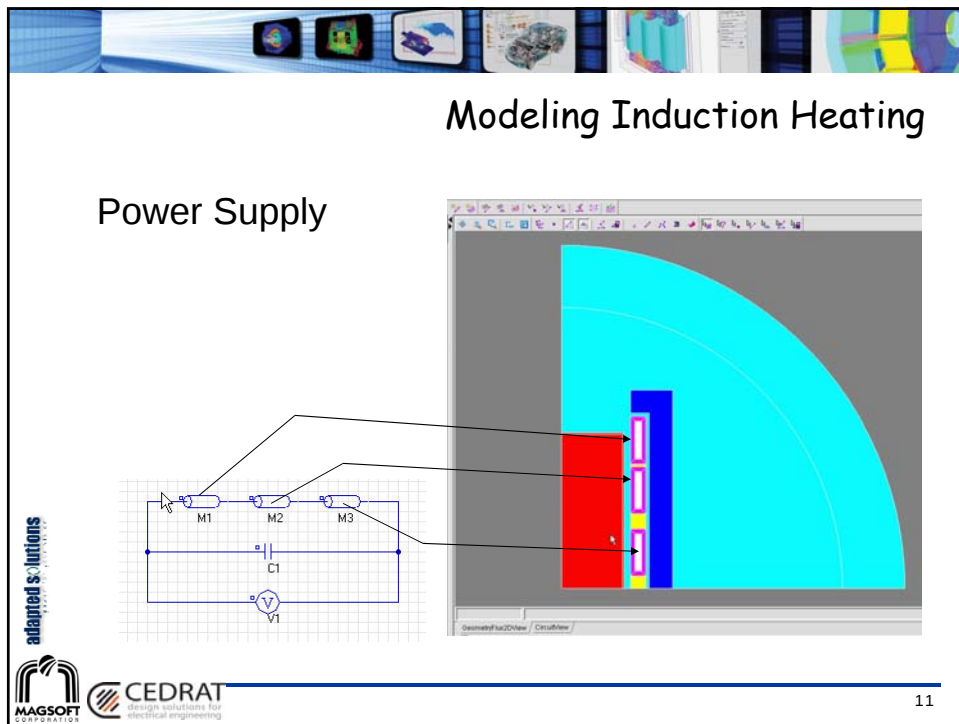
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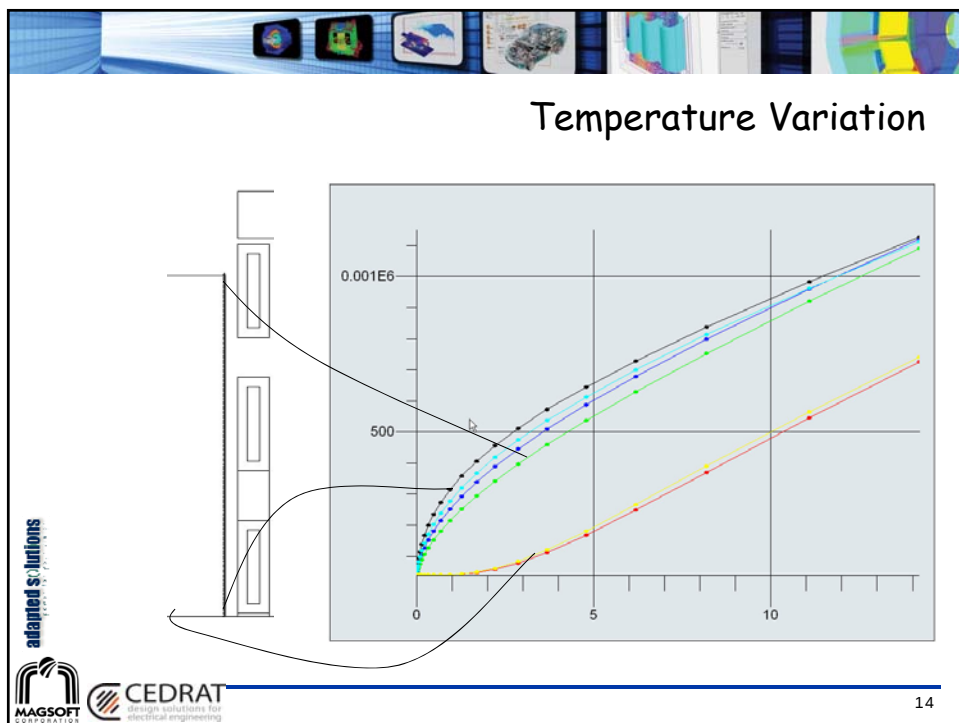
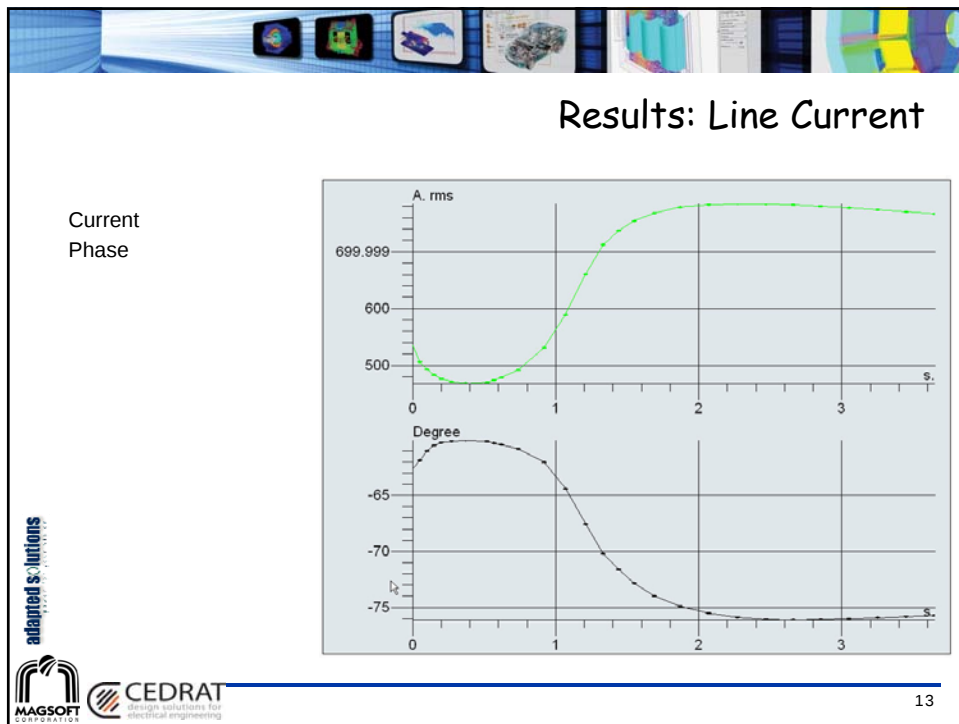
Magnetic Permeability

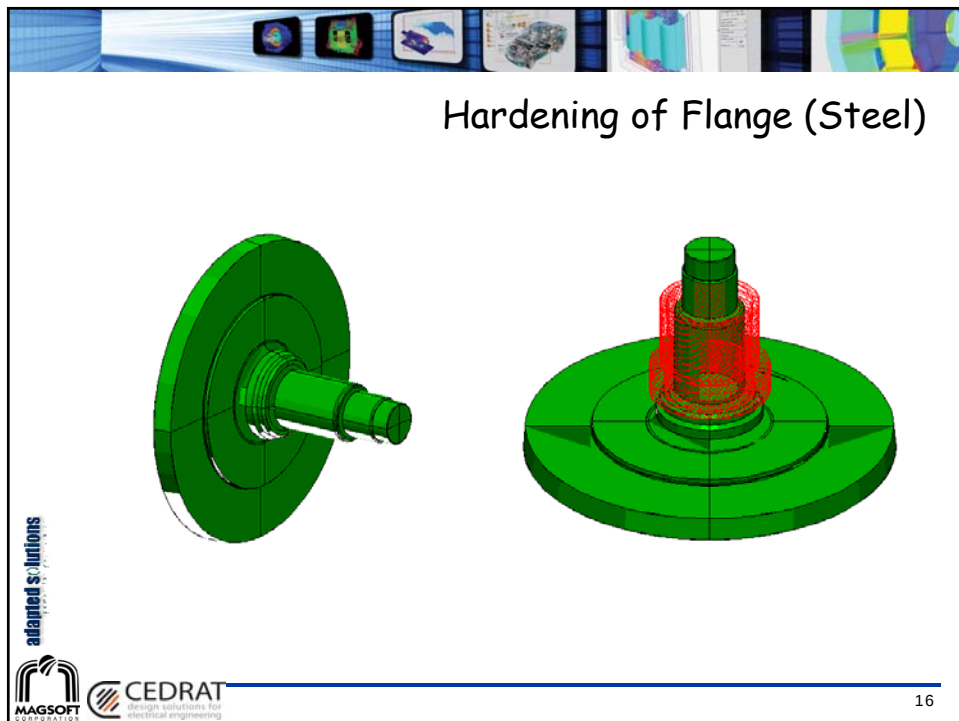
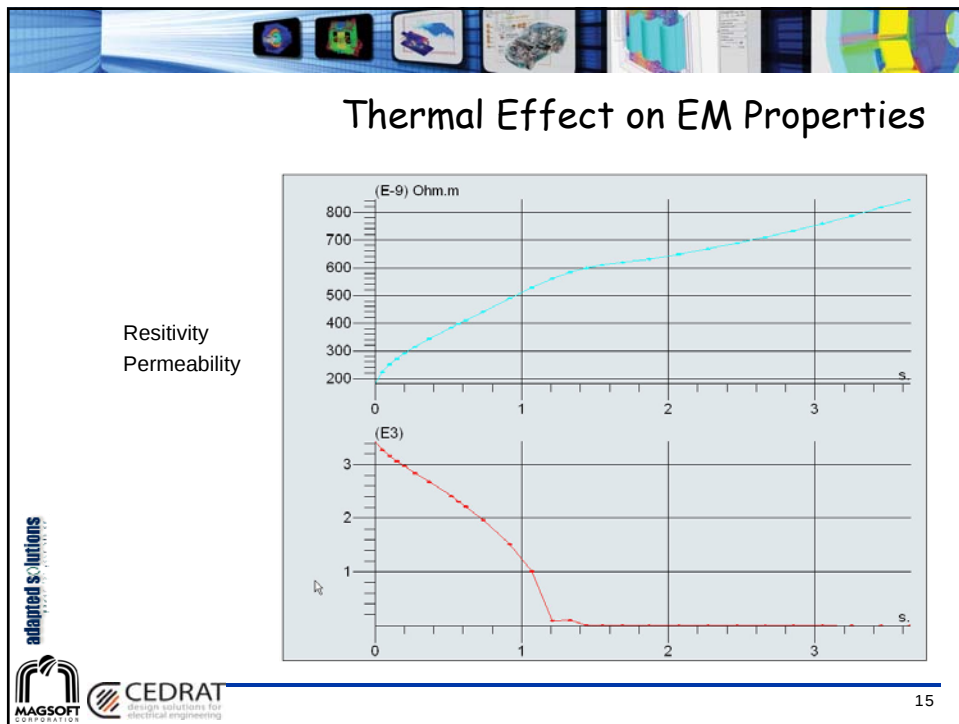


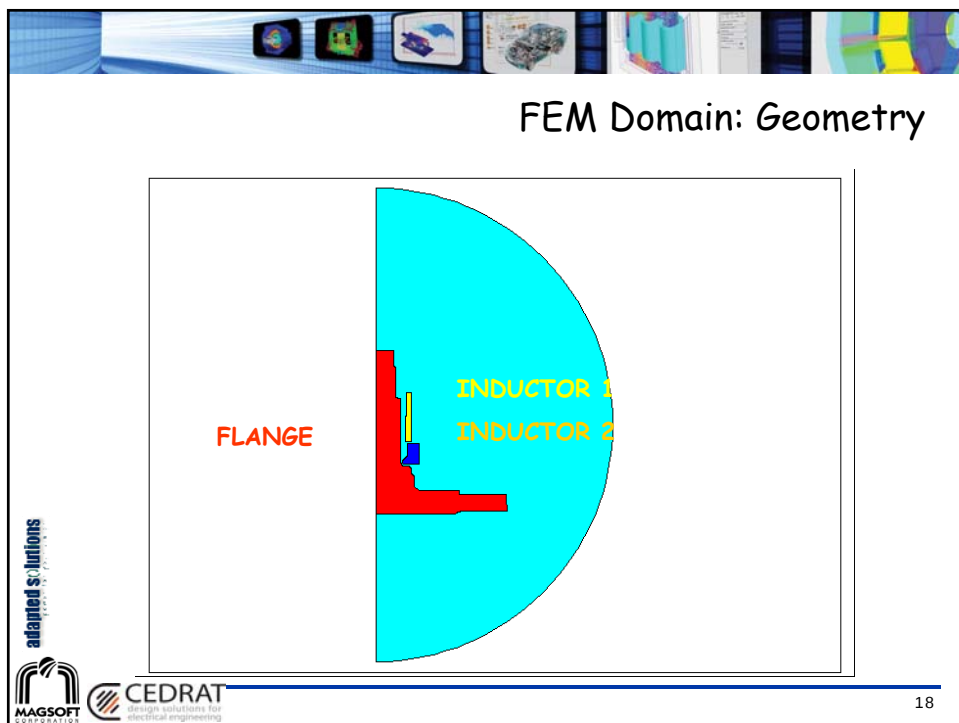
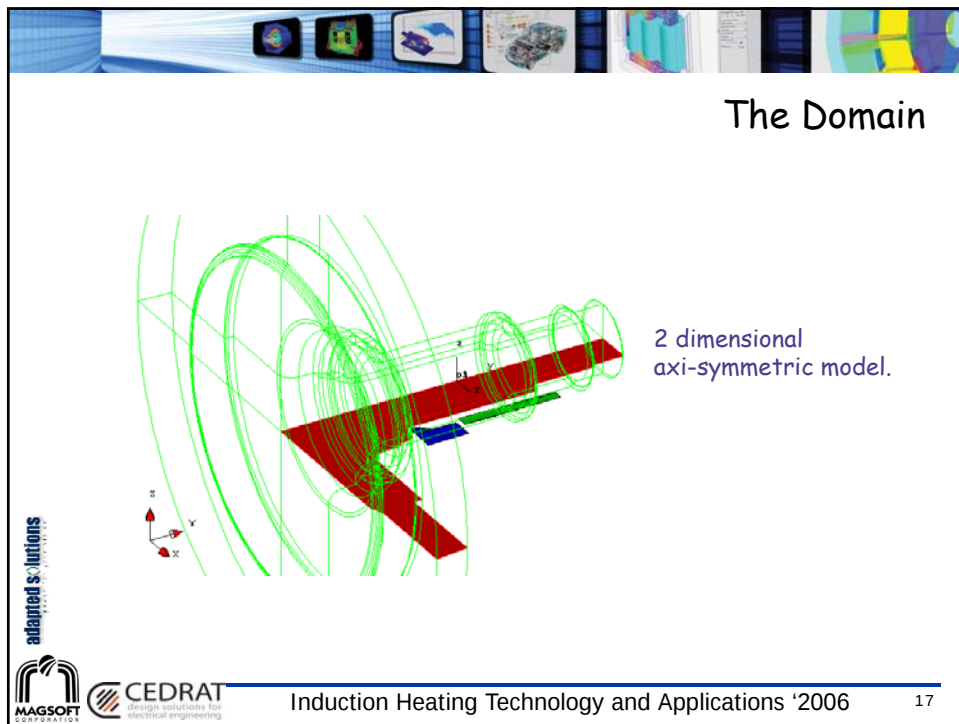
Material Properties

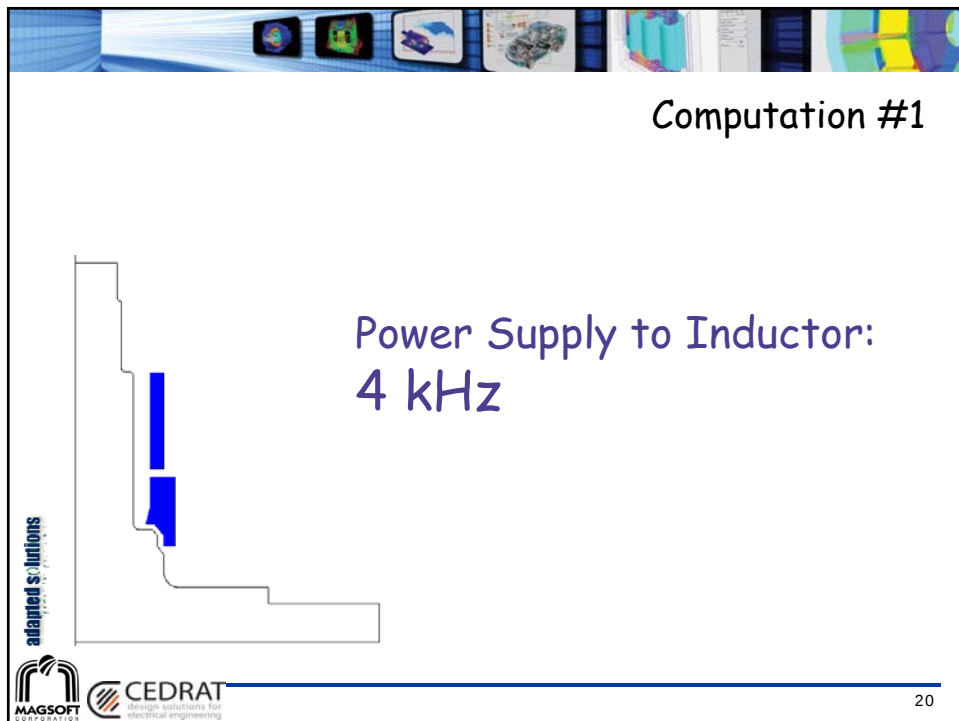
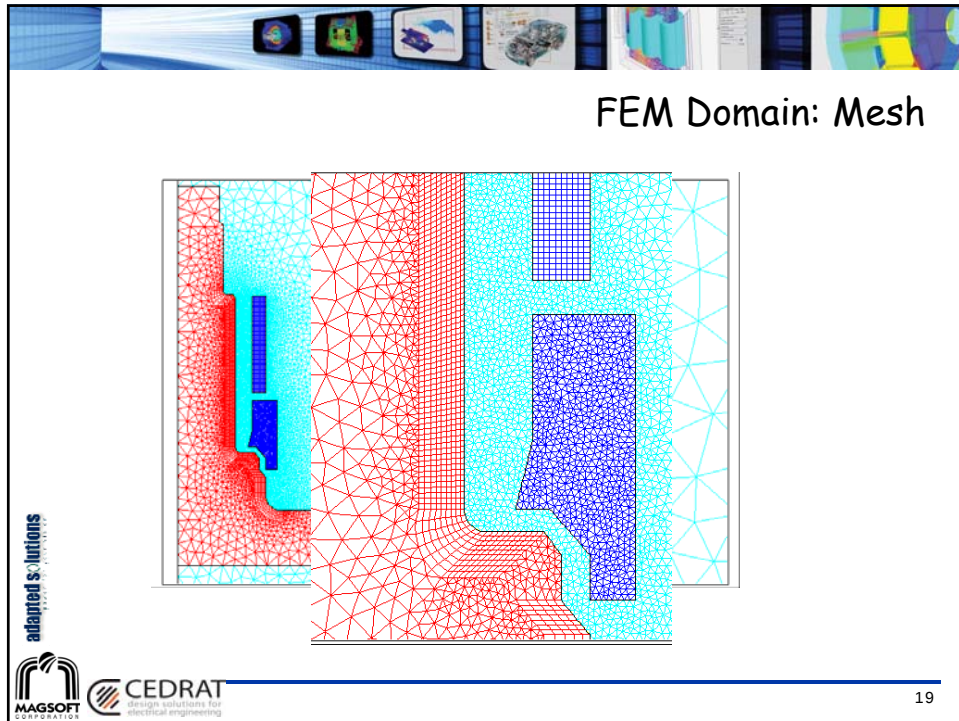


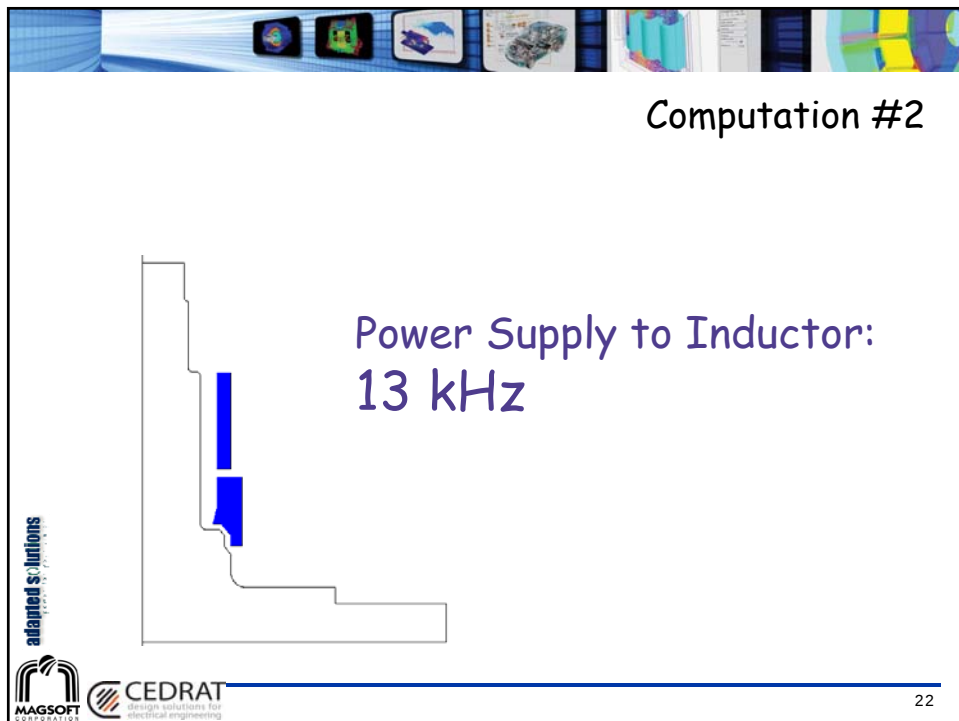
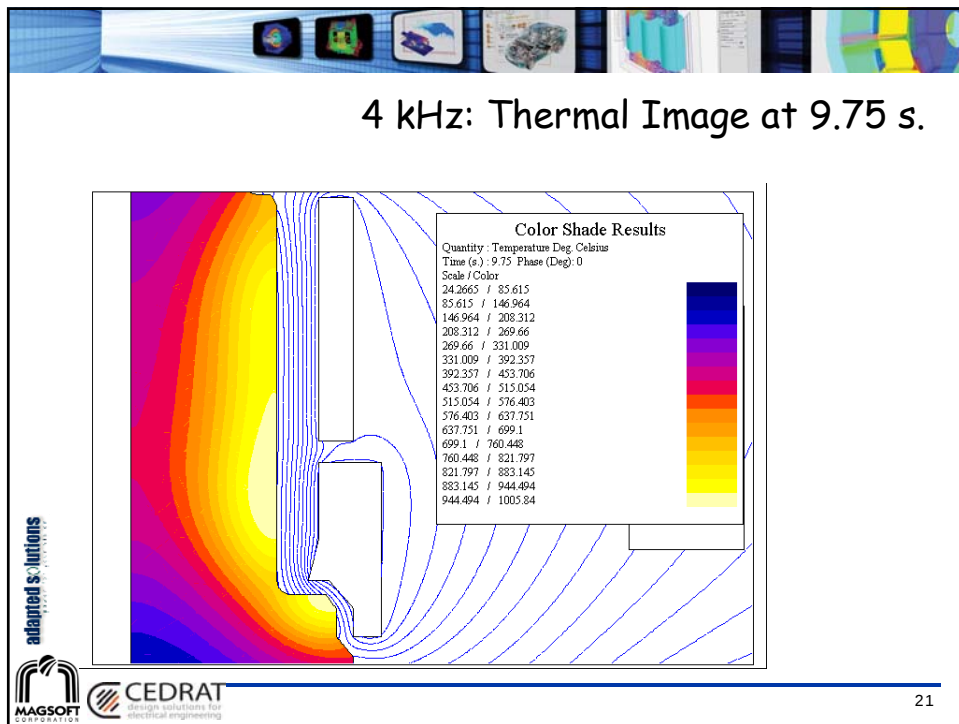


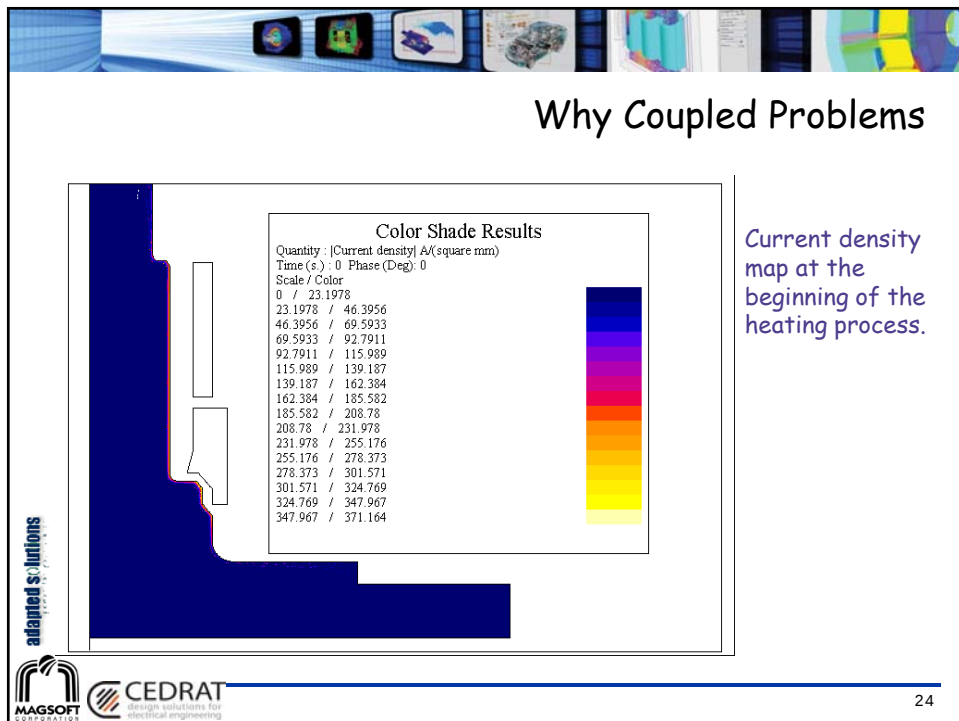
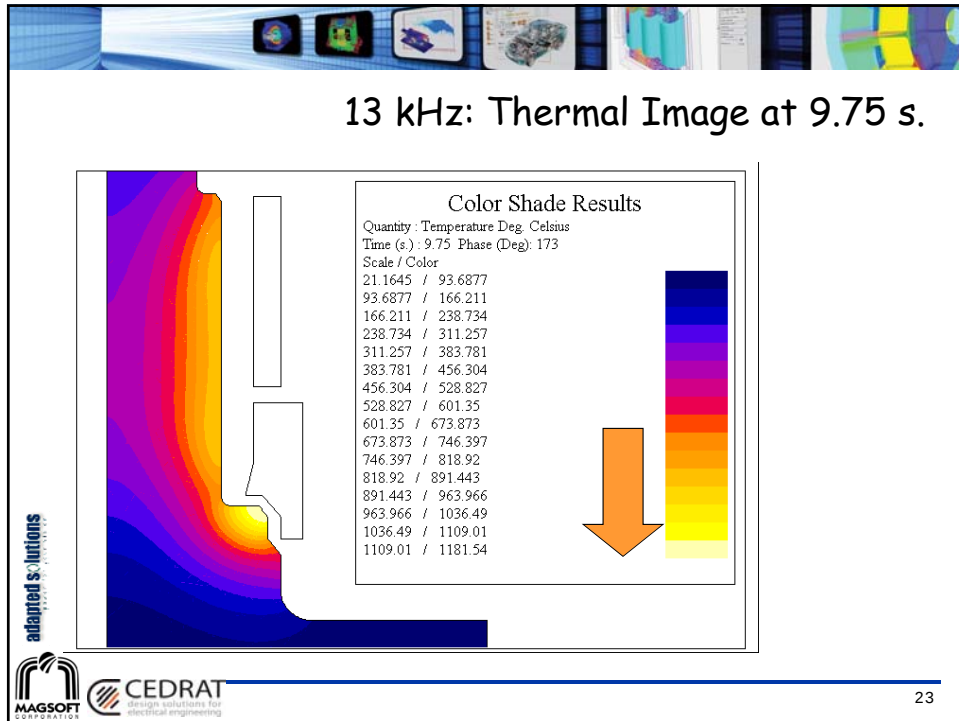


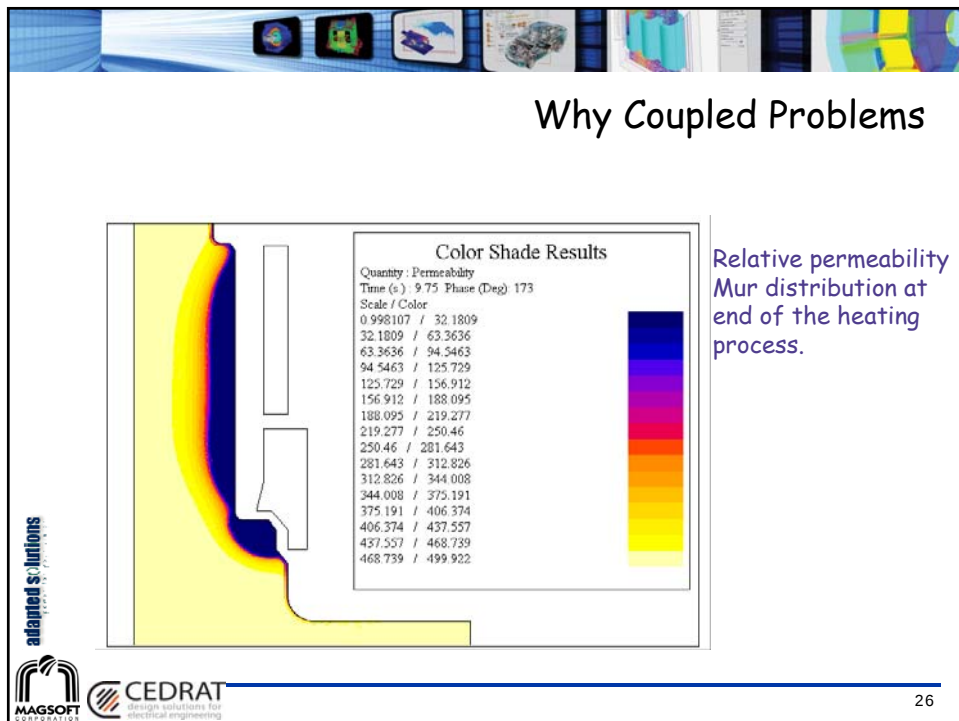
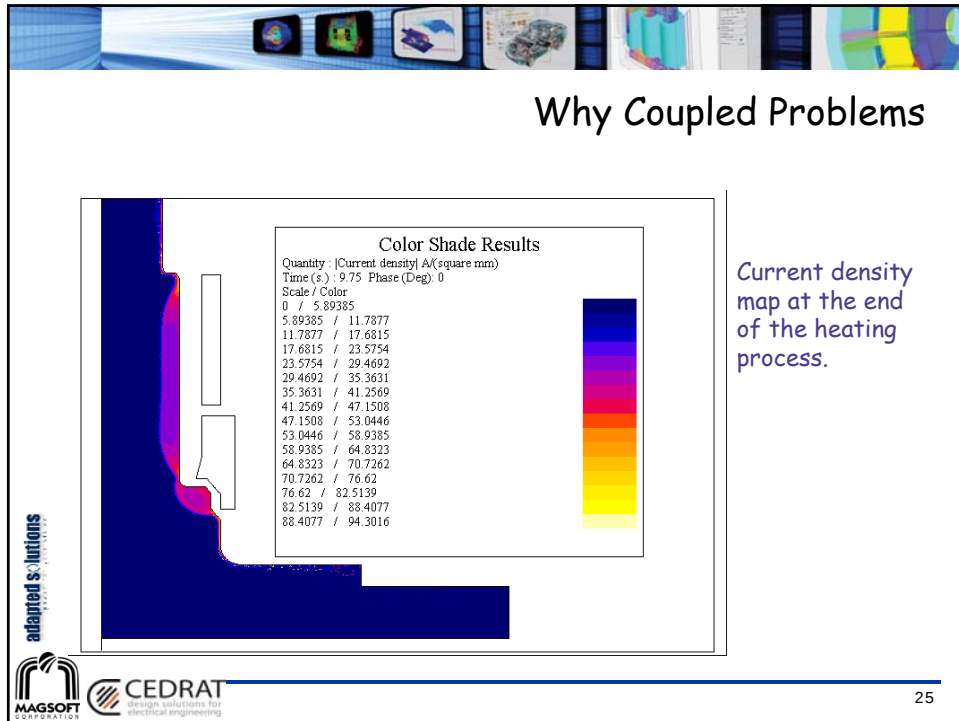


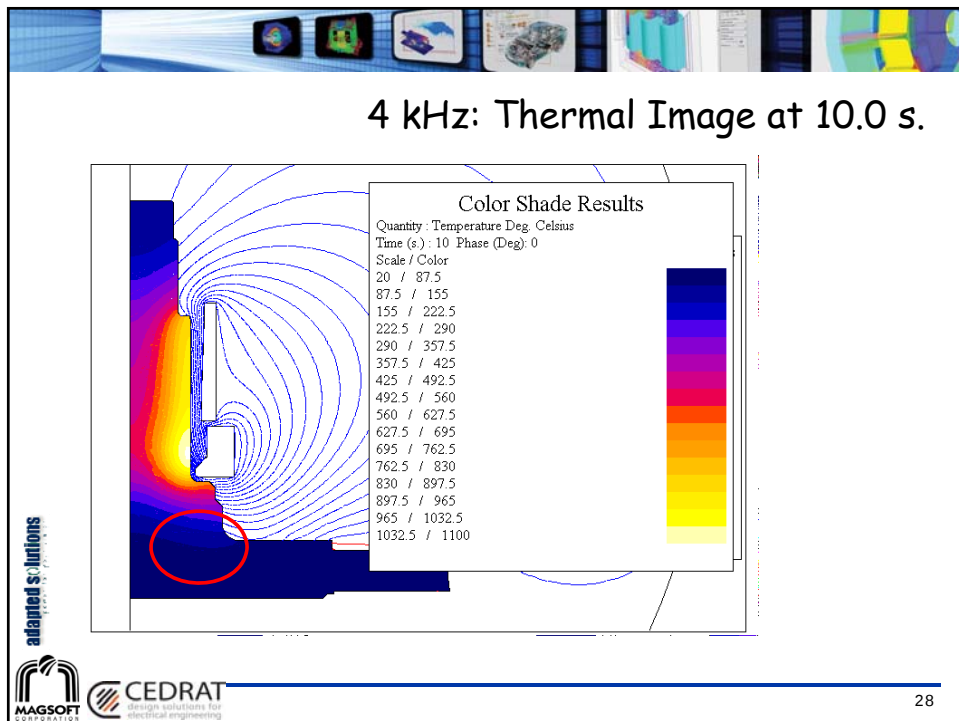
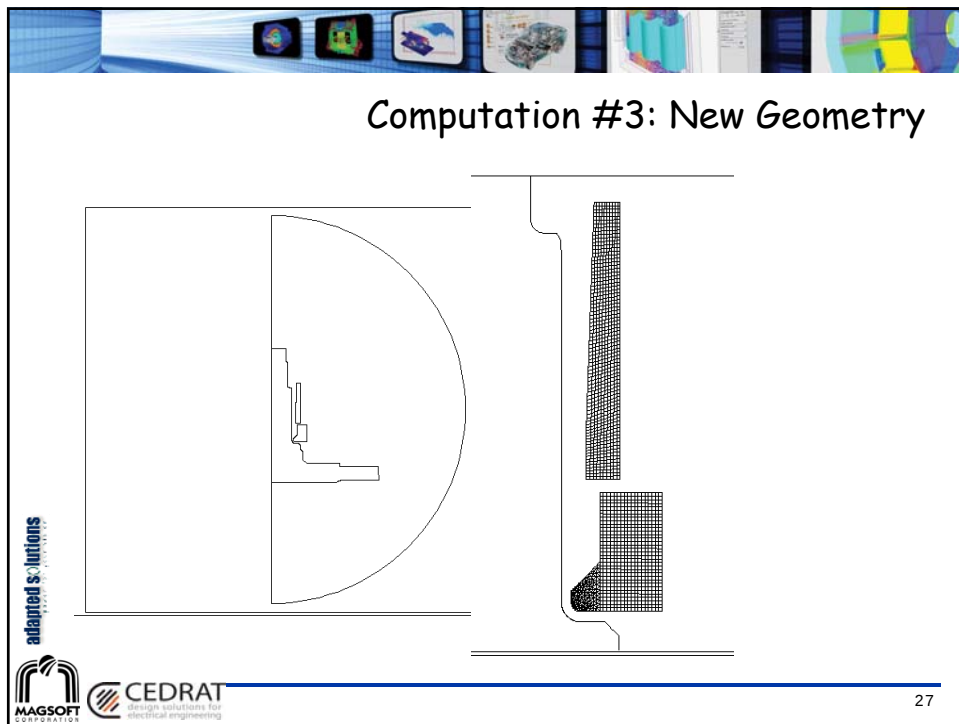


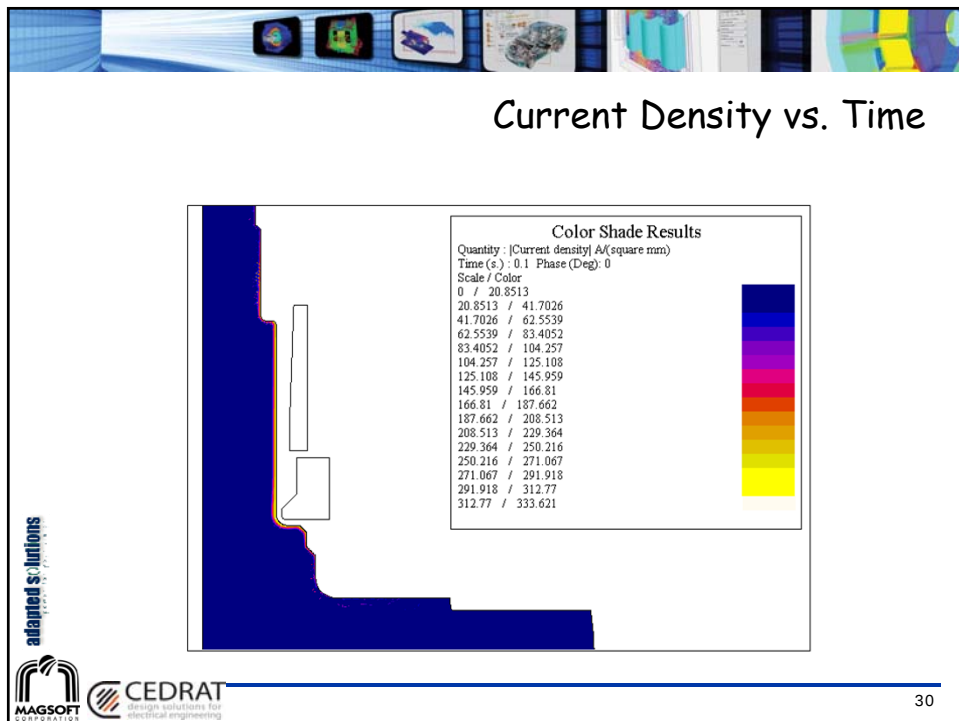
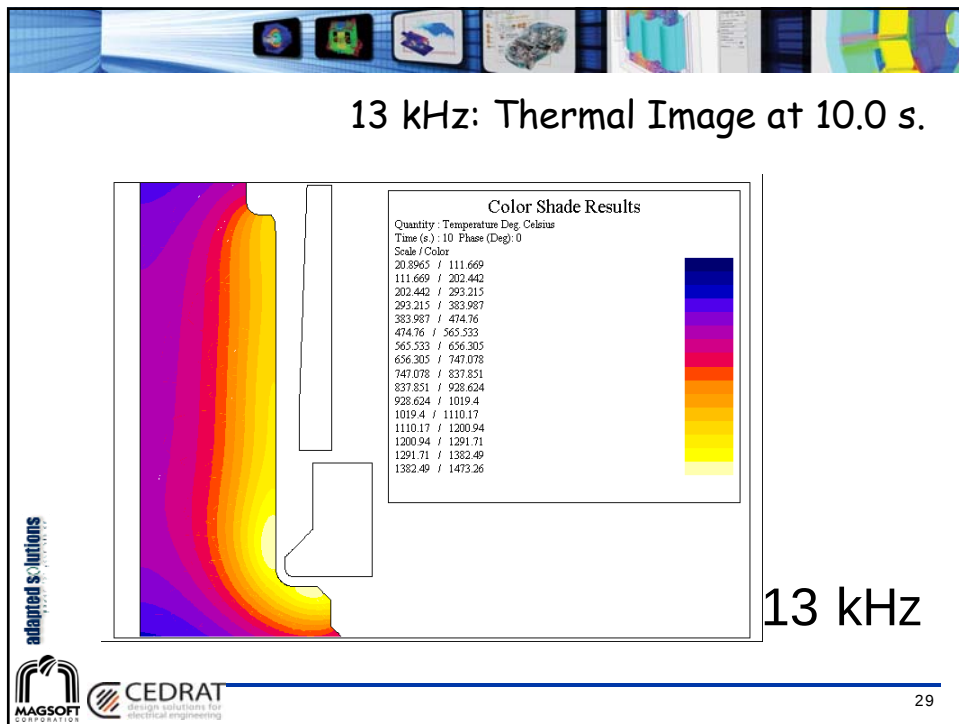


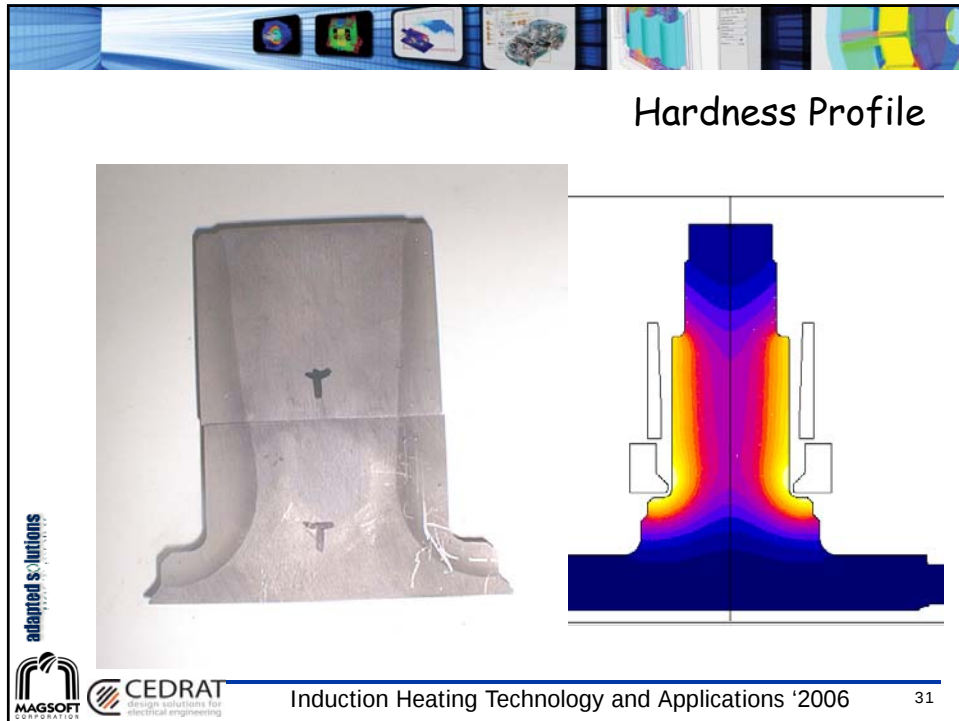












Scanning- Translating Motion

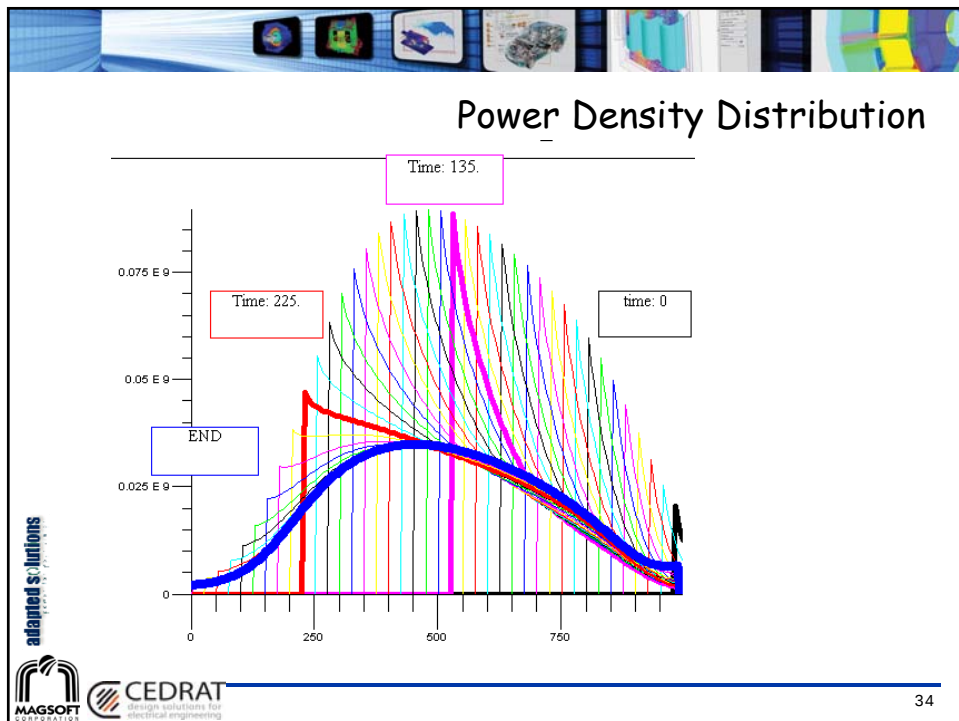
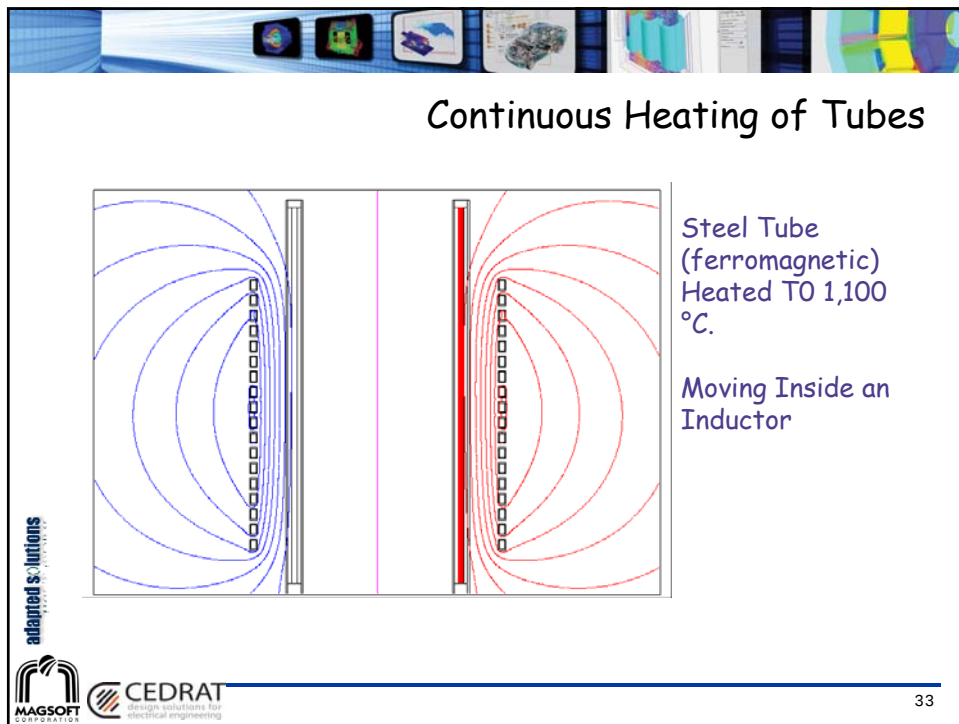
Coupled Magneto-thermal
Power supply
Motion: inductor scans the component.

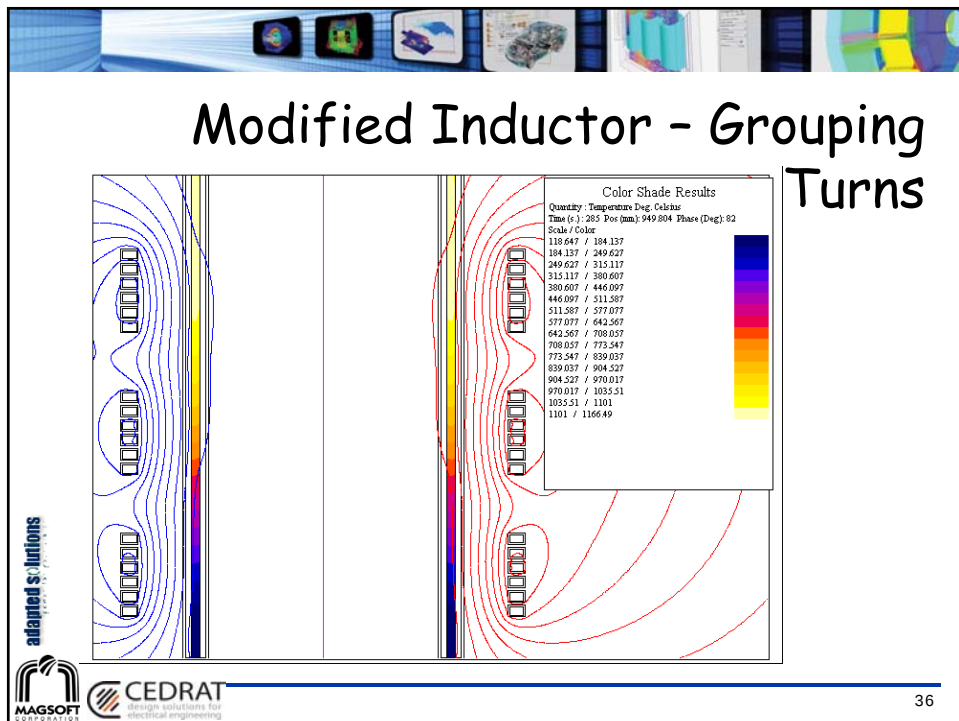
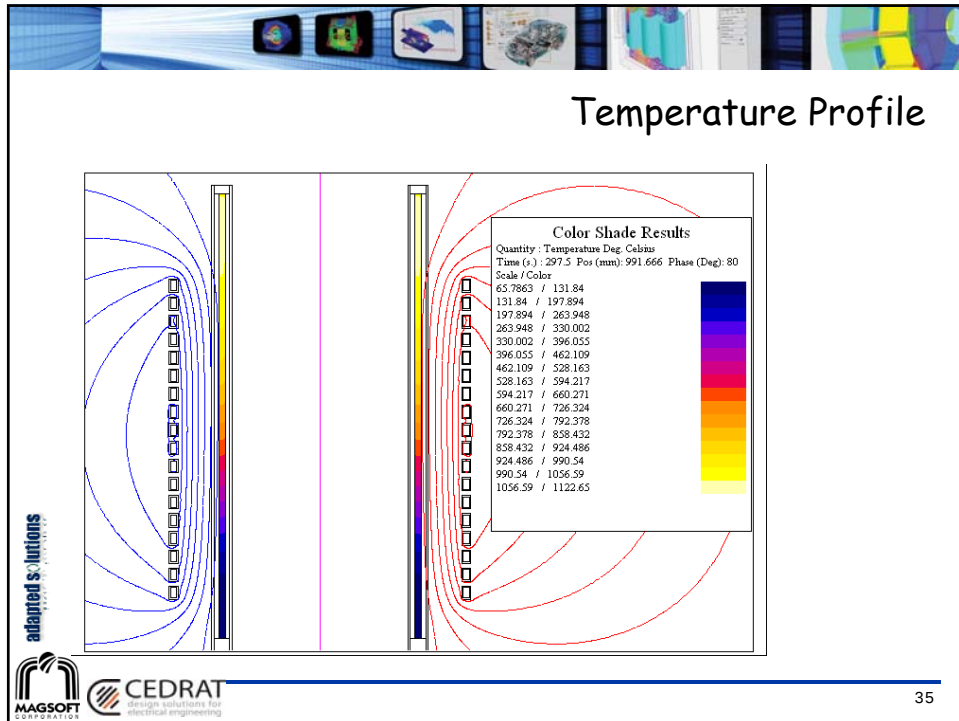
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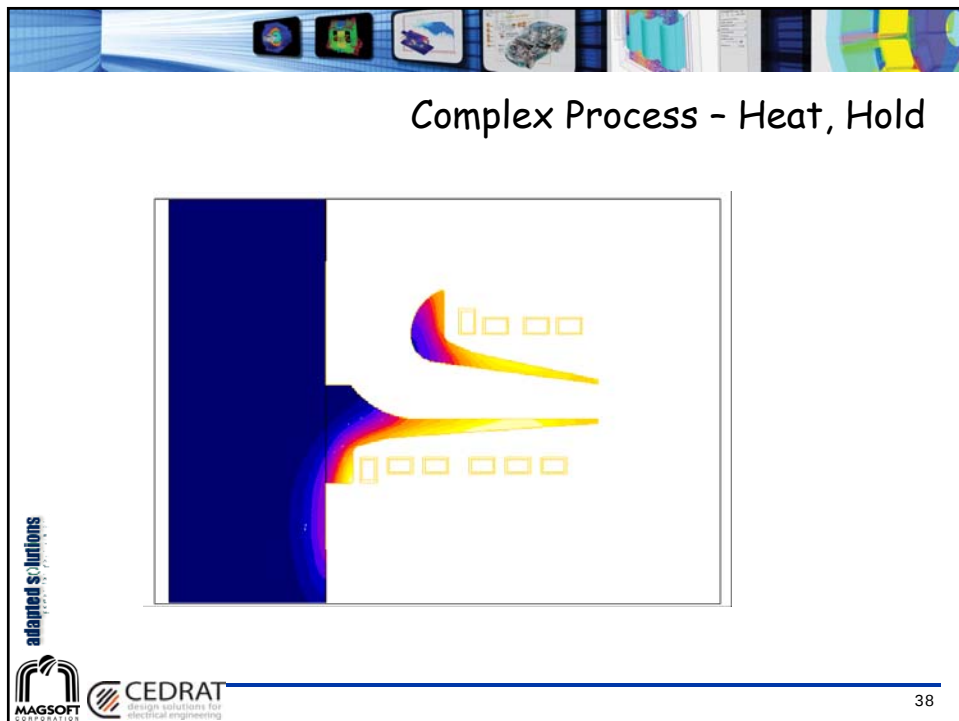
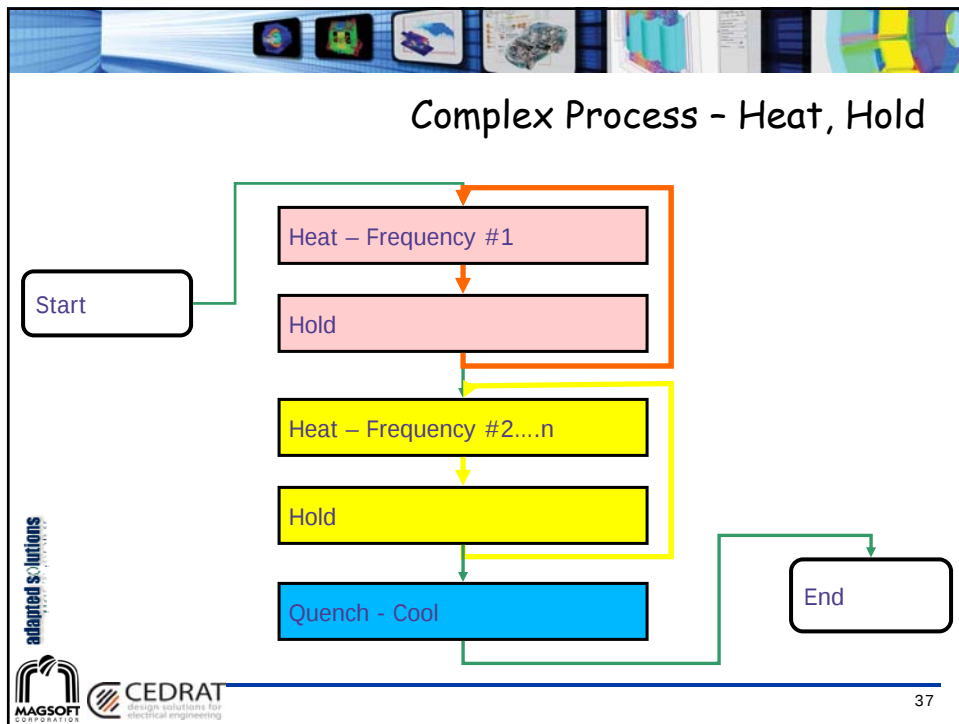
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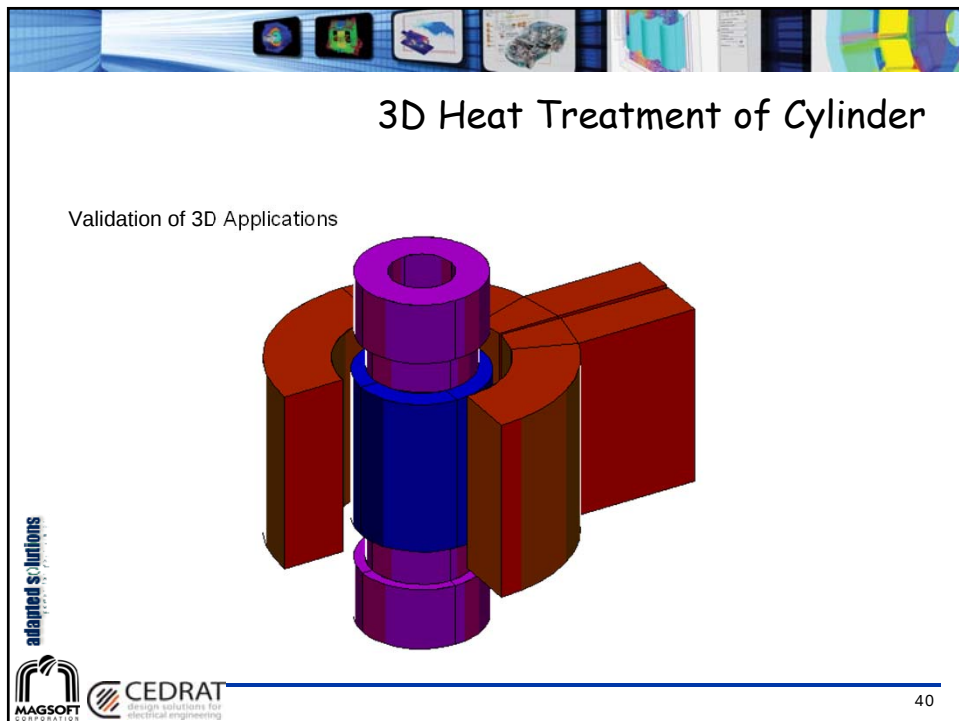
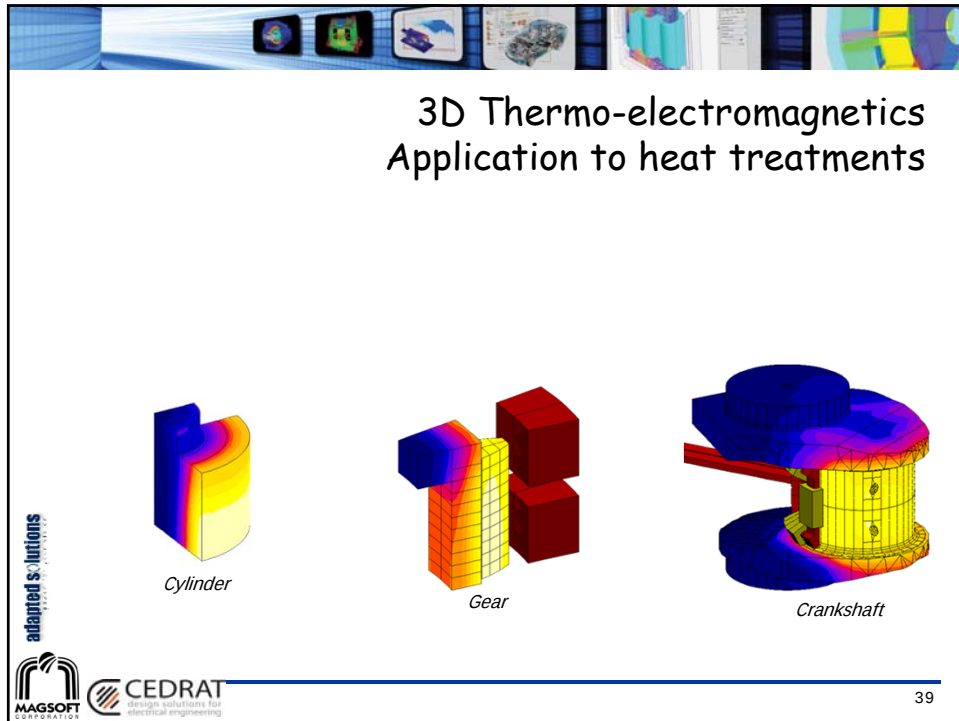
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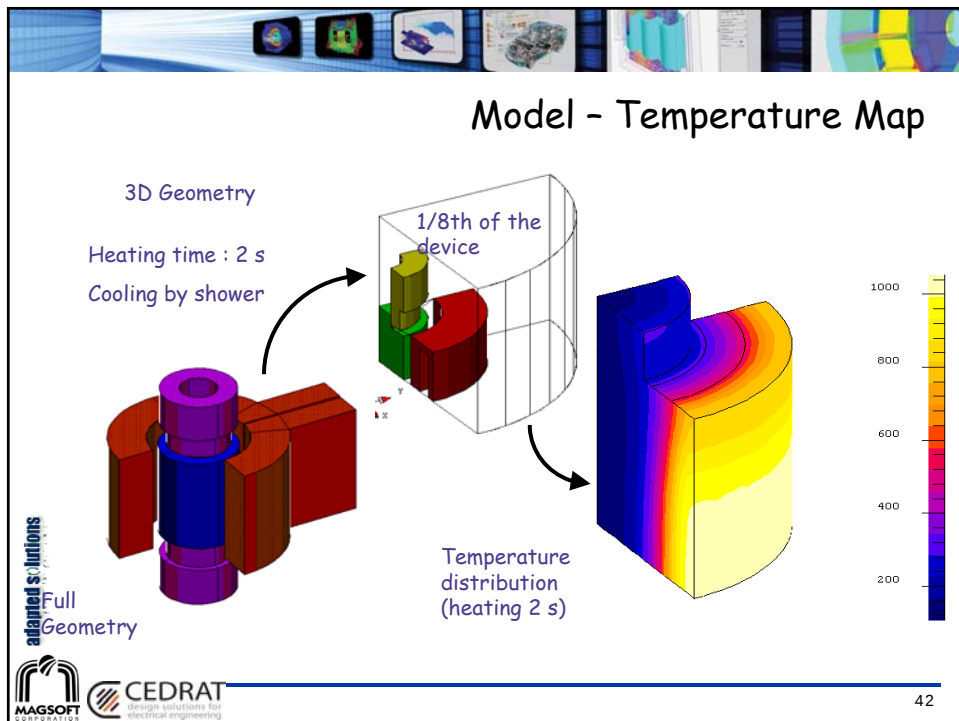
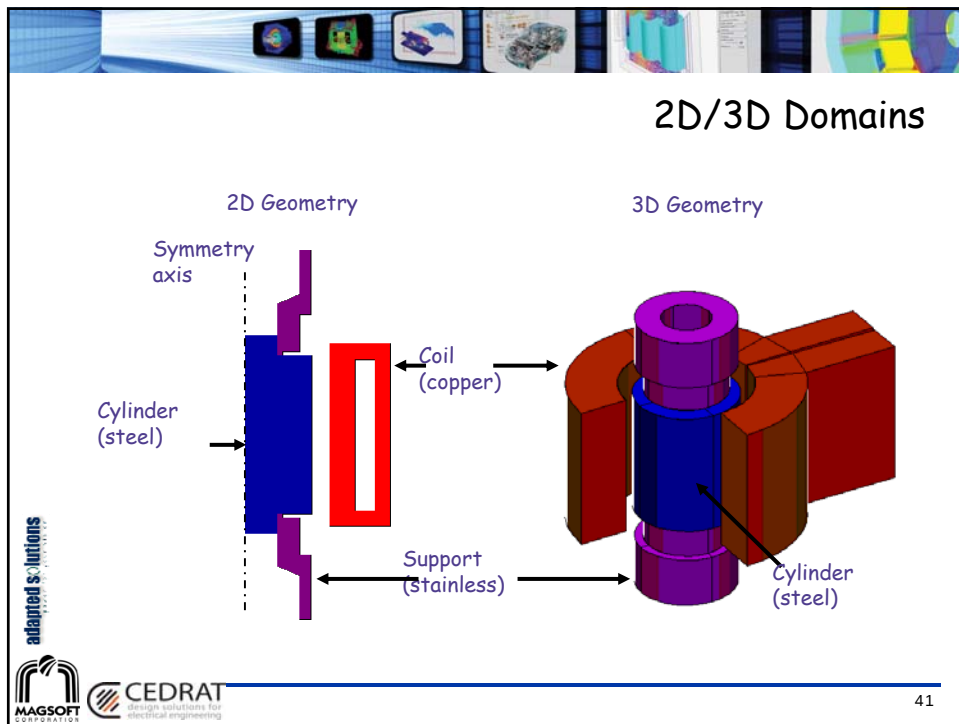
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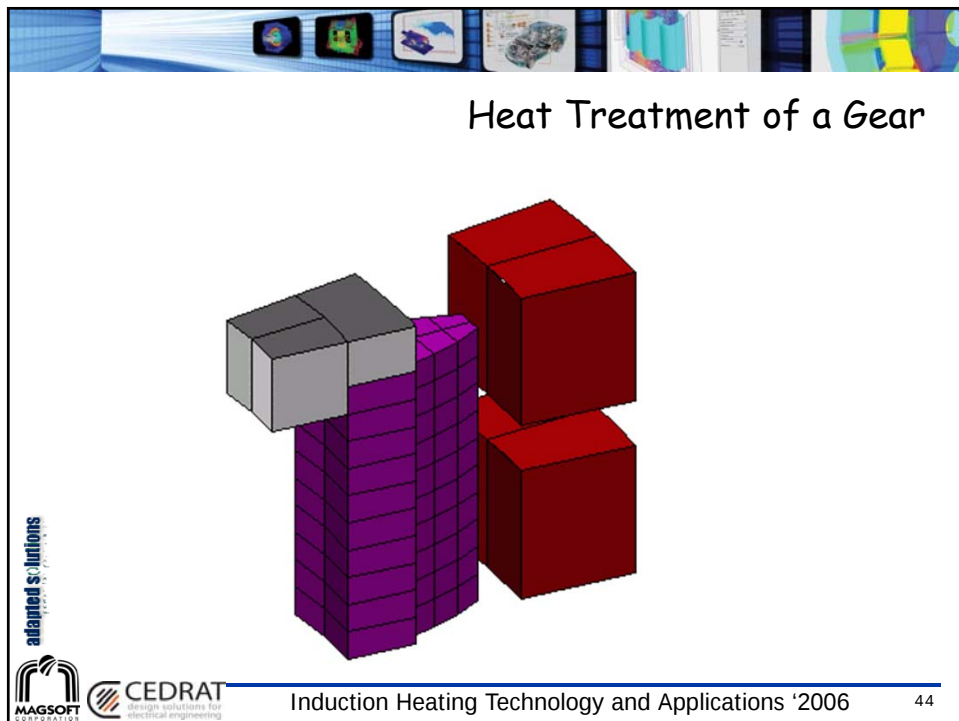
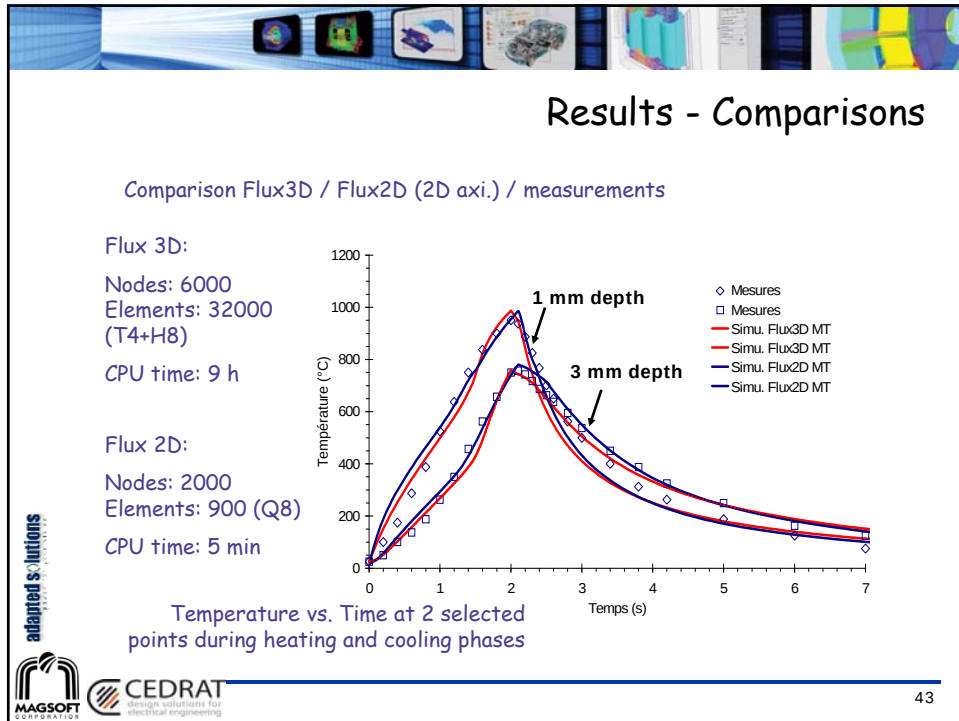


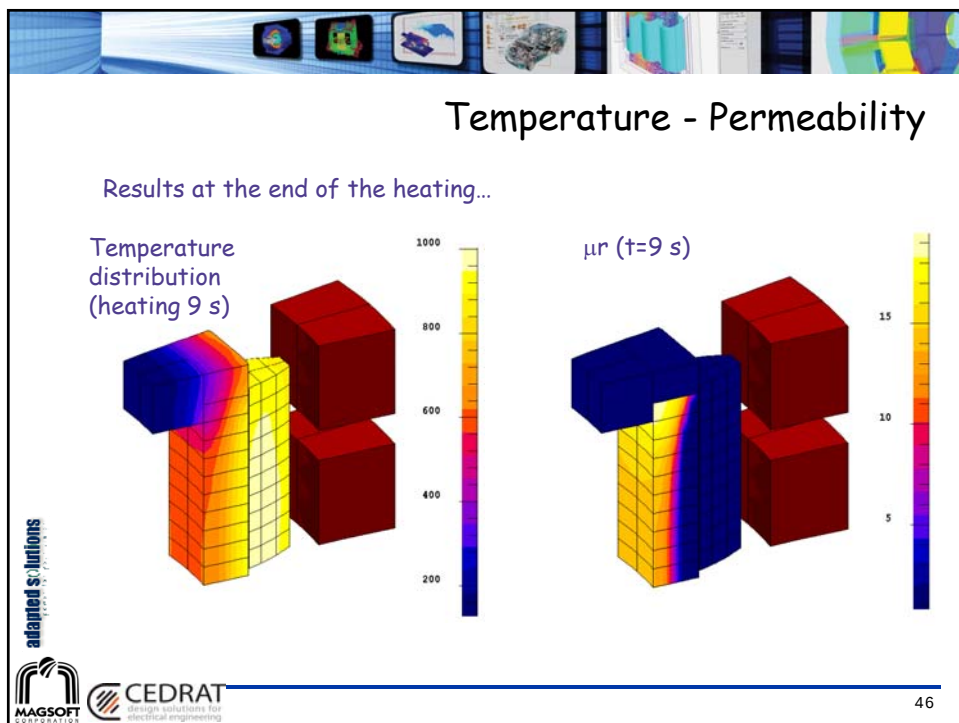
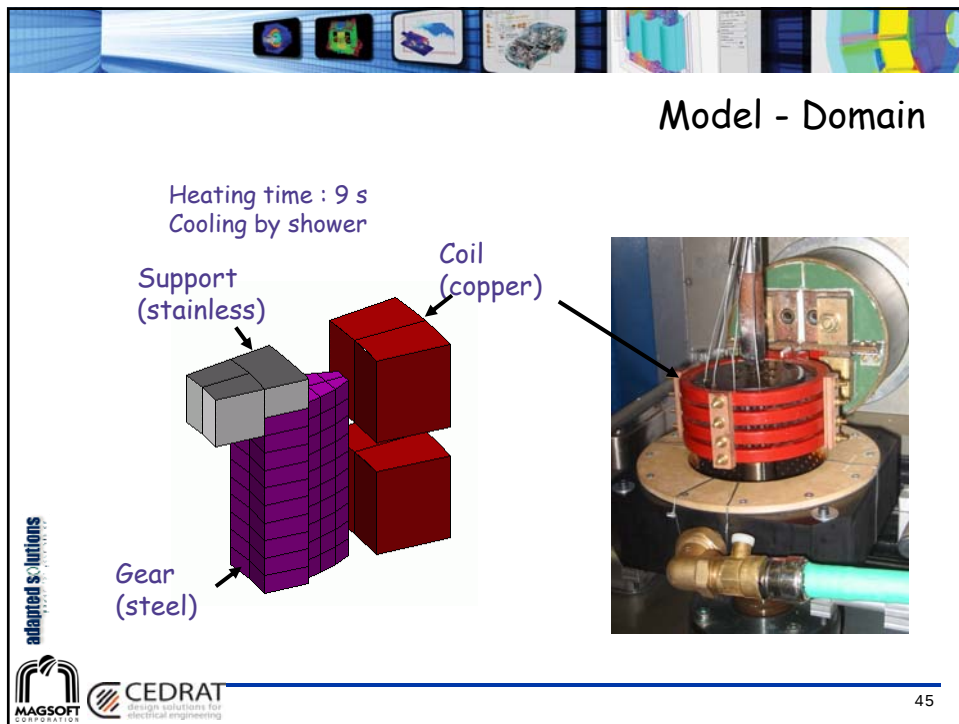


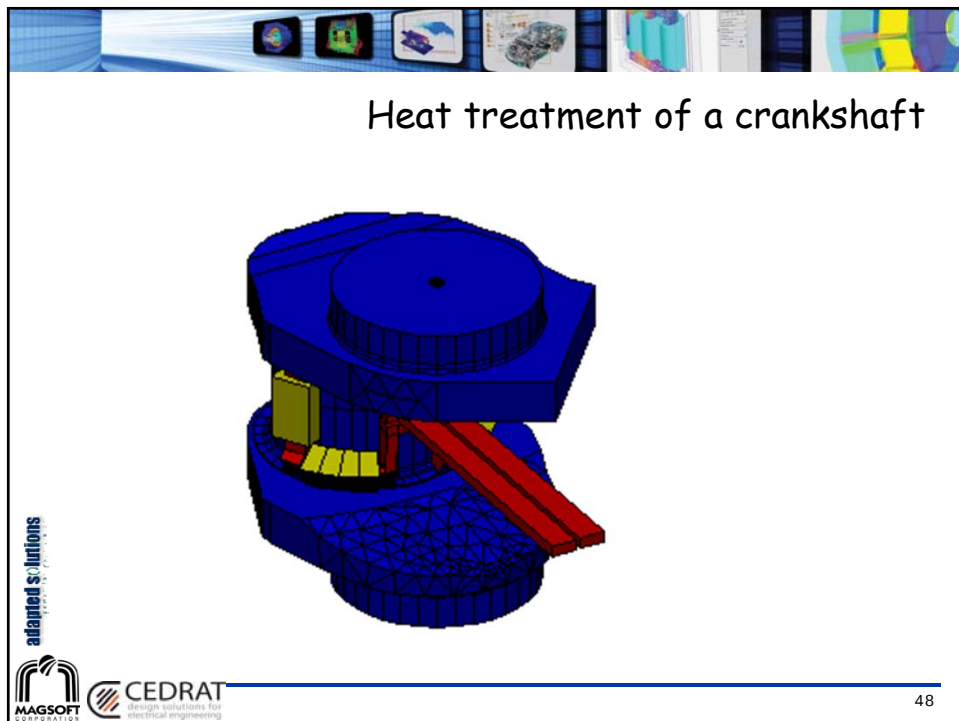
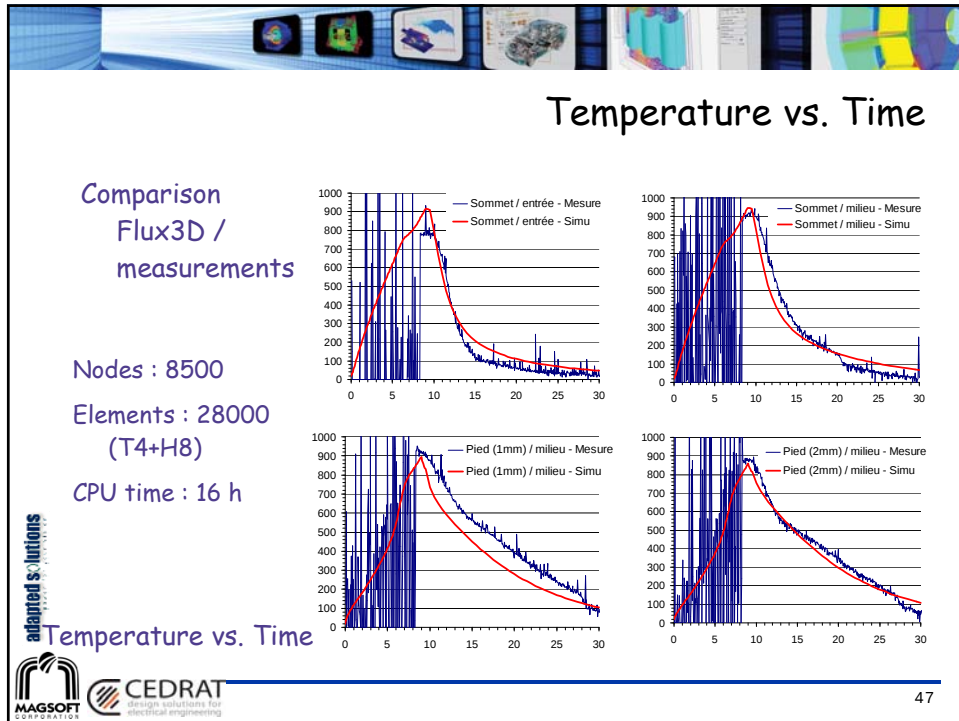






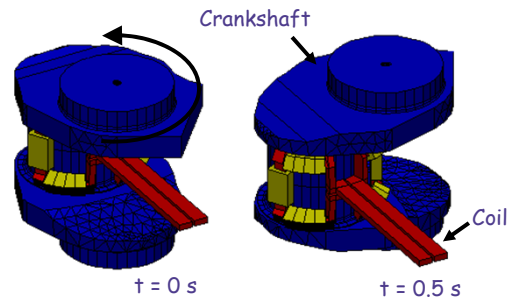






Geometry

Modelisation of the rotation of the crankshaft



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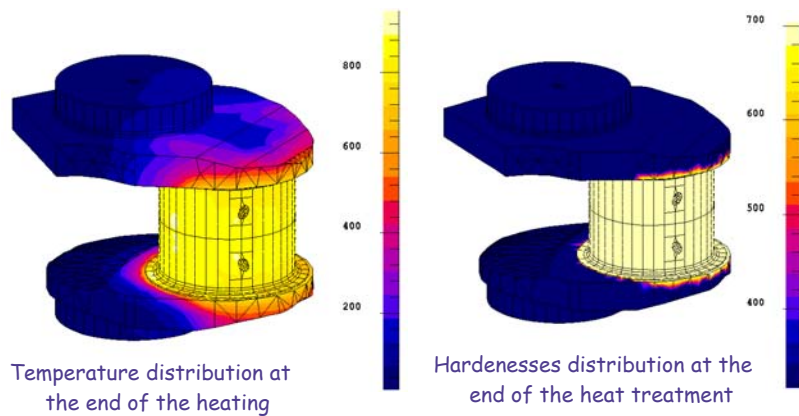


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Results

Thermal and metallurgical (Flux - Metal7) results



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