SIMHEAT®

Starting with SIMHEAT®

The time has come to discover the latest software in the Transvalor suite devoted to heat treatment processes: SIMHEAT® and the extent of its possibilities. After this course, you'll be able to get the most out of the product!

This training is your first approach to the SIMHEAT® software. The first day gives you an understanding of all of the data setup steps, how to create material files and TTT diagrams, the procedure for launching computations and how to analyze the main results. Day two will be devoted to a more thorough analysis of a complete panel of results for better interpretation of the physical phenomena. Key functions will be covered such as treatments for aluminum and heat treatments via induction as well as surface treatments. Customizing your working environment will then be covered.

LEVEL

Beginner

PREREQUISITES

There is no prior requirement for this course.

GOALS

- **Discovering the interface**
- **Data set up of a heat treatment simulation of a forged, cold formed or cast part**
- **Launching a single computation and/or a computation sequence**
- **Analyzing simulation results**
- **Defining the process conditions in order to obtain the best mechanical properties**
- **Be able to predict the microstructure changes during heating or cooling**
- **Creating your own TTT diagram using SIMHEAT®**
- **Observing the influence of the diffusion of carbon on the changes in surface hardness**
- **Determining the ideal treatment conditions in order to reduce cycle times**
- **Customizing your working environment**

TRAINING	DURATION	PRICE EXCL. TAX	PARTICIPANTS
In-company	3 days	€4500 per training	1 to 3 people

DAY 1 > 8.30 a.m. to 12.00 p.m. & 1.30 p.m. to 5.00 p.m.

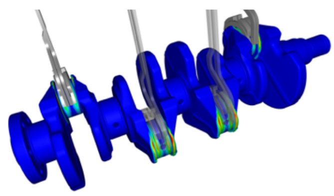
Introduction	· Presentation of Transvalor · Course goals · Review of the finite element method
Data setup	· Presentation of the environment · Concepts: stores, processes, cases and stages · Importing geometries · Handling objects (creation, trimming) · Surface and volume meshes · Definition of kinematics (if required by the process) · Rheology and thermal exchanges · Material database · Application to a tutorial · Working environment presentation · Starting computation
Launching computations	· Quick launch · Batch handler and chained simulations
General	· Fe-Fe3C diagram · Review of TTT and TRC diagrams
Modeling quenching	· Approximating the TRC diagram using the TTT diagram · Exercise: generating TTT and TRC diagrams with FORGE® · Multi-physical coupled model · Exercise: model quenching in different baths (Houghton oils, polymer solutions) · Exercise: quenching via sprays
Result analysis	· Displaying results, the main scalars and vectors · Graphs, animations, VTFx exports · Multi-window analysis · Management of animations and exporting results

DAY 2 > 8.30 a.m. to 12.00 p.m. & 1.30 p.m. to 5.00 p.m.

Austenitizing	· Generation of material composed of perlite and ferrite · Definition of the heating cycle · Report analysis: phase transformation, austenite content, optimizing the heating cycle
Carburizing	· Generating anisotropic mesh · Defining the carbon content · TTT diagram according to the carbon content · Result analysis: carbon content, phase transformation, hardness
Tempering	· Model used to determine hardness · Exercise: modeling of tempering after quenching · Result analysis: residual stresses, hardness, etc.
Optimization	· Basic optimization principle · Determining exchange coefficient thanks to reverse engineering
Working environment customization	· Creating specific models and specific data sets (materials, heat exchanges, etc.)
Conclusions	· Questions and course assessment

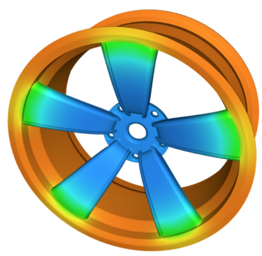
DAY 3 > 8.30 a.m. to 12.00 p.m. & 1.30 p.m. to 5.00 p.m.

Modelling	· Maxwell's equations · Definition of the heating cycle · Coupling between thermal and electromagnetic aspects · Properties: electric resistance, magnetic permeability, skin thickness, etc · Coupling with metallurgy
Induction heating (Tutorial case)	ELECTROMAGNETIC COMPUTATION · Defining of the input and output current · Definition of the mesh for the 'Room mesh' environment · Creation of the global mesh · Mesh suited to the skin thickness · Checking the quality of the global mesh THERMAL COMPUTATION · Defining the billet · Parameters of the simulation: storage, heating time, coupling with electromagnetic computation STARTING COMPUTATION · Chained computation by setting the 'In Loop' tab · Chained induction and forming simulation ANALYZING RESULTS · Evolution of temperature, magnetic fields, magnetic potential, induced current · Display a field in an isovolume
Symmetry	· How to model symmetry · Boundary conditions of Maxwell's equations
Induction with movement by the part or the inductor	· Continuous or step by step motion · Application: a multiple of billets moving inside the inductor
Conclusion	· Questions and course assessment



Induction heating of a crankshaft

Surface heat treatment (carburizing, quenching, tempering)



Hardening via aluminum precipitation (artificial aging)