

Example of heat treatment simulation of a spoked steel wheel

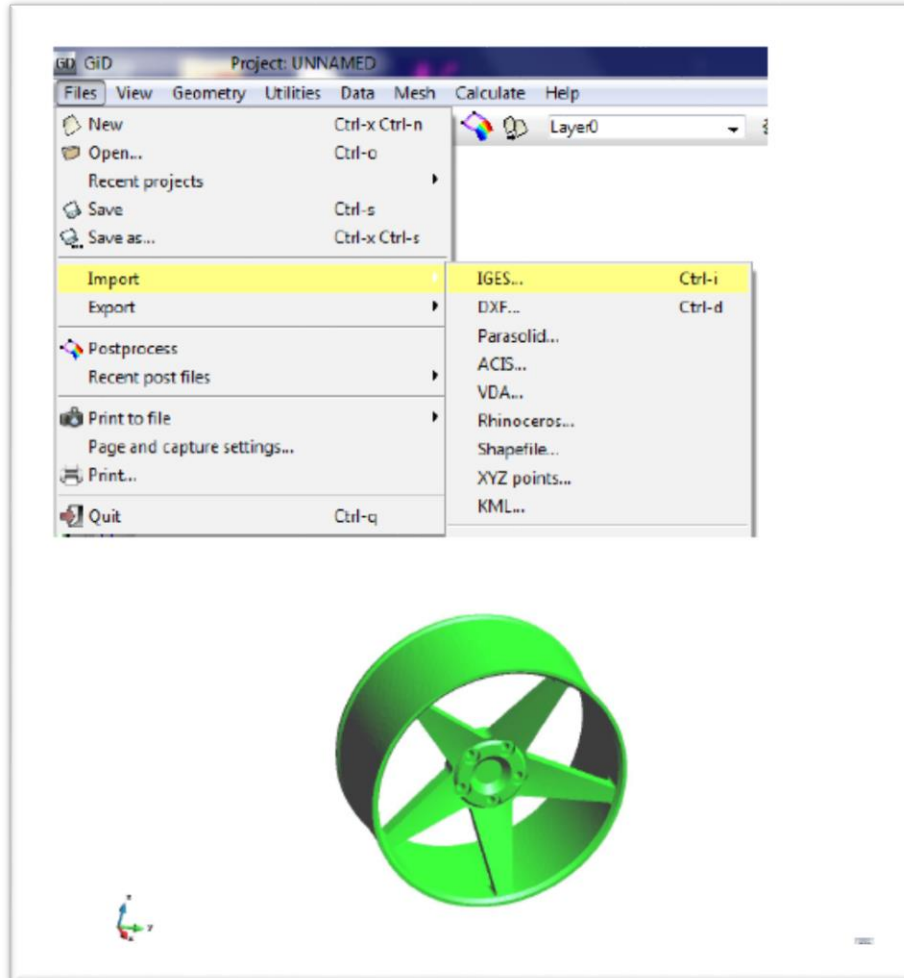


Fig 1. The solid model of the component is imported into the FEM Preprocessor software, GiD

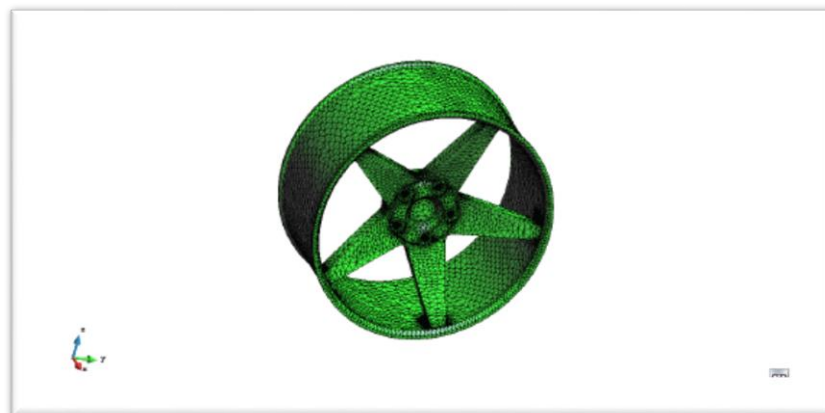


Fig 2. The solid model is discretized for finite element analysis

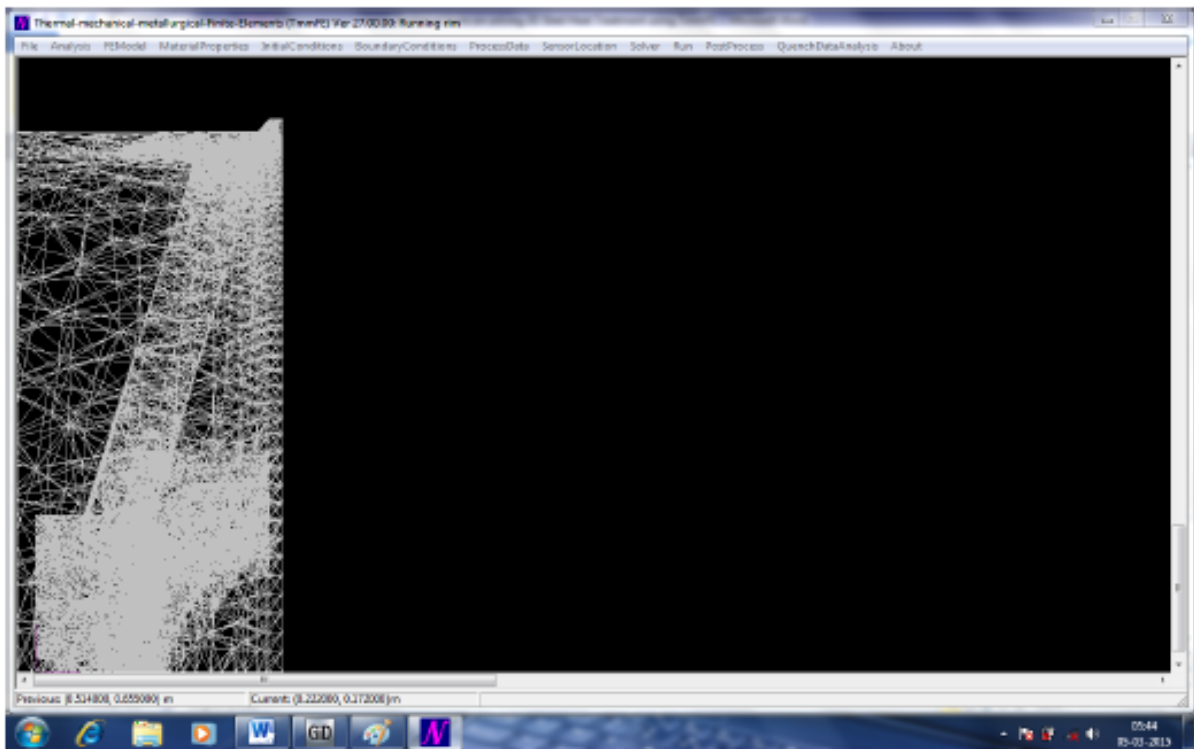


Fig 3. The discretized finite element model is imported into TmmFE_HT software for simulation

Material Properties

Steel Composition/Critical Temperatures TTT Diagram Properties Data

Case Hardened Steel: Increasing Carbon % ---->

☐ Core(1) ☐ Low C(2) ☐ Medium C(3) ☐ High C(4) ☐ V High C(5)

Thickness (mm)

OK

Read Steel Data

Steel Composition

Steel Name: 8630(C30Mn80Si45)

C	0.3	Cu	0
Si	0.45	V	0
Mn	0.8	B	0
Ni	0.55	N	0
Cr	0.5	S	0.015
Mo	0.2	P	0.015

Steel Grade

☒ Hypo-eutectoid
☐ Hyper-eutectoid
☐ Eutectoid

Reset Save

Critical Data/Temperatures

Aust - Ferrite begin (Ae3)	763.59
Aust - Cementite begin (Acm)	N.A.
Austenite/Pearlite begin (Ae1)	727.10
Bainite Start (Bs)	567.50
Ferrite End (Bn)	544.19
Martensite Start (Ms)	354.00
Martensite End (Mf)	238.00
Austenite Fraction at Mf	0.10
Transformation temp	912.00
Eutectoid Carbon	0.76
KM Factor	0.02

Refresh

Formulae for Carbon Equivalent

☒ TmmFE ☐ CEw (Cottrell) ☐ CE (IIW) ☐ CET ☐ CEN (Yurioka) ☐ CEq (Duren) ☐ Pcm (Bessyo)

Carbon Equivalent:

Save

Steel Casting Heat Treatment Solver Form

Solver Heating/Quenching Time End Condition

Heating Time (h:m) :

Transfer Time (h:m) :

☒ Quench ☐ Normalize

Time (h:m) :

Time Steps

Furnace Heating (sec)

Transfer / Normalizing (sec)

Quenching (sec)

OK

Fig 4. Chemical composition of the steel, preheating time, transfer time and quench time are input to TmmFE_HT software along with other parameters

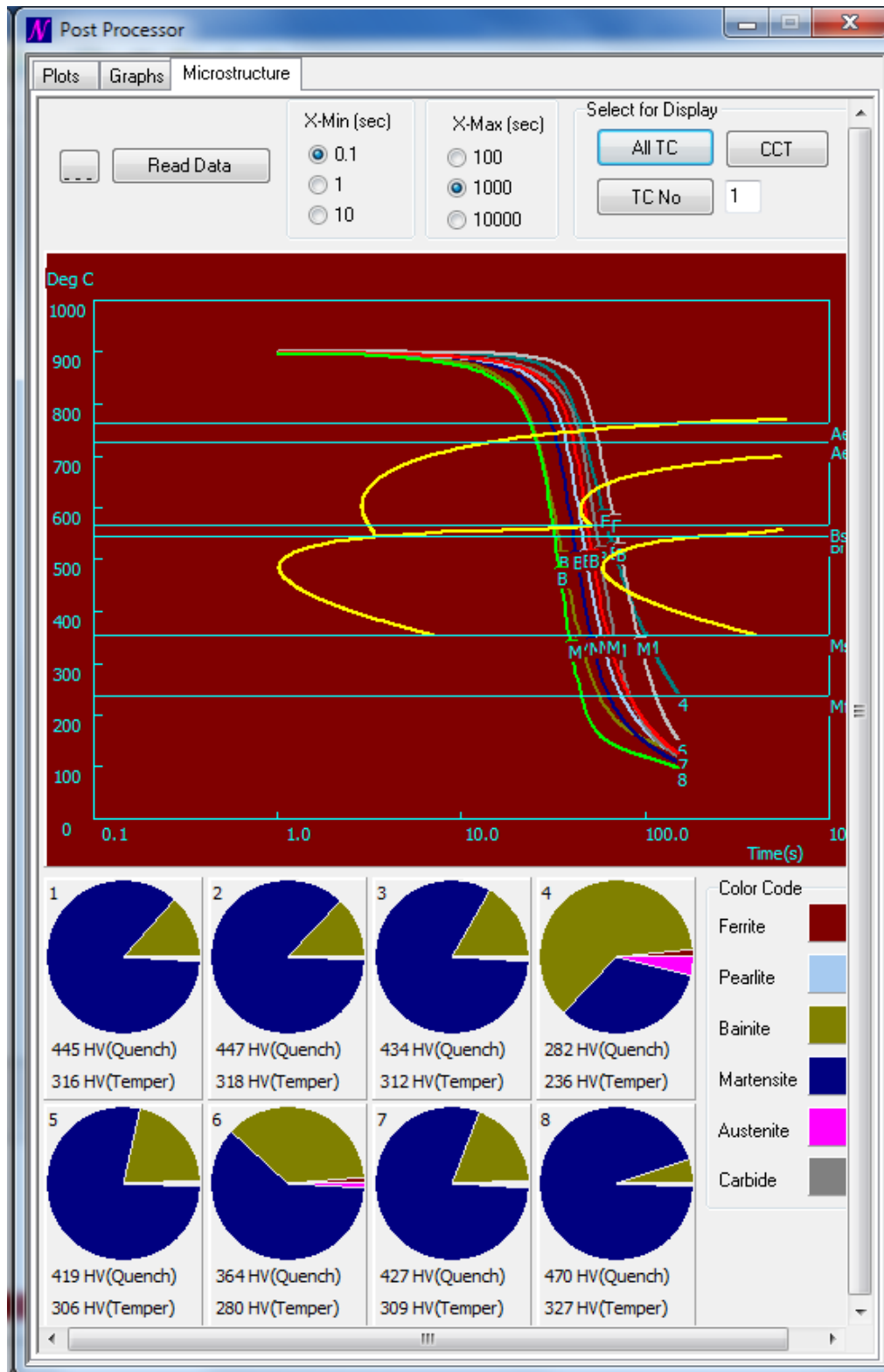


Fig 5. TmmFE_HT output shows the microstructure distribution, as quench hardness and tempered hardness at selected locations. The cooling curves are shown superimposed on the TTT curve for the steel.

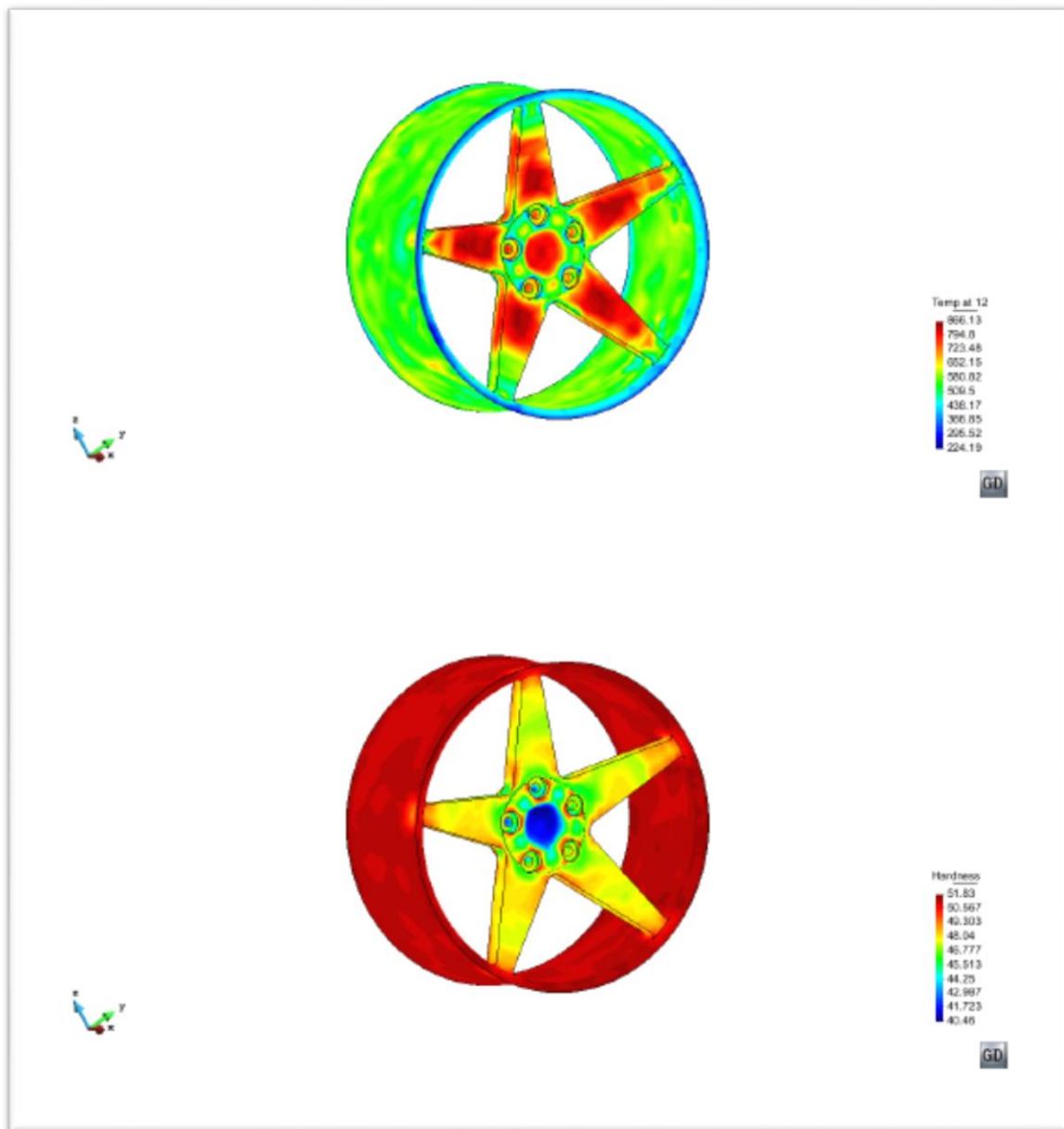


Fig 6. The simulation results are exported to Gid Postprocessor where it is viewed in 3D format.