

Metal casting processes and metallurgical treatments

H2020 SOCIETAL CHALLENGES: Climate action, environment, resource efficiency and raw materials

PRODUCTIVE SECTOR: Energy and Environment

PROBLEM DESCRIPTION

Mathematical modelling and numerical simulation for solving the thermal problem arising in the solidification (phase-change) of a metal casting inside a sand mould. Subsequently, quenching processes produce microstructure metallurgical transformations that are responsible for modifications in mechanical properties.

CHALLENGES AND GOALS

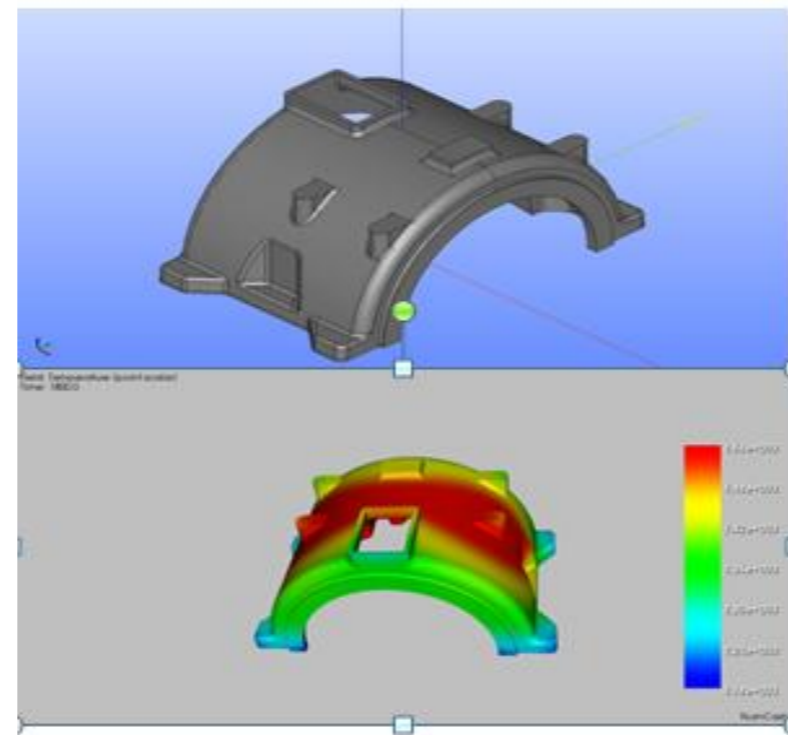
Replace or complement the tests in casting processes and thermal treatments of bearings to reduce material and energy costs, improving the life of the equipment and the final quality of the products.

MATHEMATICAL AND COMPUTATIONAL METHODS

Mathematical Modelling: Partial Differential Equations

Heat transfer: Phase change, Shrinkage cavities, Quenching, Metallurgical microstructures

Finite Element Analysis (FEA): CastFEM (own code), Code-Aster (free software)



Mathematical modelling and numerical simulation for the heat transfer on foundry solidification bearings by CastFEM code.

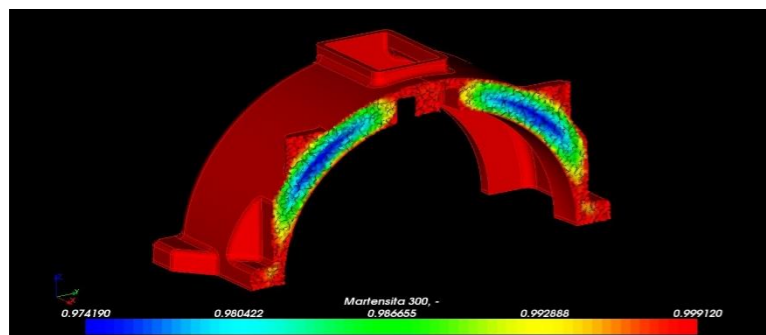
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Results and Benefits

The result of the project has been the development of a numerical simulation tools that allow to analyze in detail the process of thermal treatment of metals. These tools allow identifying the weak points of the process and analyzing possible modifications in order to improve the final product.

At the same time, the developed tools are very flexible and easily modified to be able to predict the thermal treatment of pieces in other conditions (in the face of both a redesign of the operation and the design of a new process).

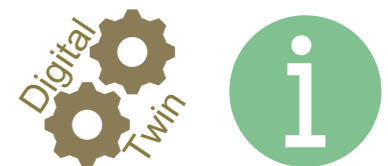
Using the numerical simulation, the company got great advantages instead of using experimental tests.



Numerical simulation of the martensite distribution at the end of quenching (pool boiling) by Code-Aster.

"The numerical simulation has great advantages over experimental testing, thereby reducing material cost and energy and, in general, associated with final product quality."

(Fundiciones Rey)



Spanish Network for Mathematics & Industry (math-in)



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