Heat Treatment Analysis of Multiphase Steel
Using a Reduced Multiscale Model

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ABSTRACT

Multiphase steels have been widely used on many applications, and some of them require heat treating the material in order to achive the desired strength, machinability or formability. Nevertheless, during quenching, hardenable steels may suffer dramatic changes in their microstructure and, consequently, in their properties. Such processes may lead to the appearance of undesirable effects, namely residual stresses and distortions on steel parts, whose quantification still represents a challenge.

In this context, a reduced multiscale model is proposed, being capable of accounting for phenomena such as elastoplastic anisotropy, mixed hardening, viscous effects and phase transformations. It uses the microstructure evolution and spatial distribution of the constituents as the source of information to predict the overall thermomechanic response [1, 2]. Furthermore, the presented model is a reduced one that allows a proper characterisation of the microscale (microstructure) and the macroscale without engaging in a larger number of degrees of freedom.

This reduced multiscale model was implemented in the finite element software ABAQUS (providing therefore engineers and new researchers with a methodology to create their own transient multiscale model), and consists in an original non-conventional model due to its non-linear macroscopic material model enhanced microscopic characterisation being capable of modelling phase transformations and anisotropy in great detail.

REFERENCES

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