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# Finite element estimation of internal stresses induced by the carburizing quenching process.

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## Abstract

Carburizing-quenching is a thermochemical surface aimed at hardening the surface of steels and making them more resistant to friction, wear and corrosion (1). It consists in carbon atoms diffusion at high temperature, followed by a rapid cooling to obtain a martensitic microstructure. This process generates residual compressive stresses at the subsurface of the sample, which play a major role in the final mechanical properties (2).

This work aims to estimate the spatiotemporal evolution of the residual stress profile, to predict the mechanical behavior and evaluates the impact of the quenching process. It is based on the use of Abaqus software and user-defined subroutines to account for the coupling of the different physics involved in this Metallo-thermo-mechanical coupled problem (3).

Especially, several mechanical contribution were considered in the carburizing-quenching process modelling: elastic, plastic and thermal strain, transformation strain due to martensitic transformation, transformation plasticity strain for the plasticity due to phase transformation, and the expansion strain rate linked to carbon diffusion. The importance of taking transformation plasticity into account in order to correctly predict internal stress profiles was elucidate, as shown by several studies. (4)

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