SIMULATION OF THE MATERIAL BEHAVIOUR OF SHEETS DURING THE DEEP DRAWING OF VEHICLES BODIES

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ABSTRACT

At the origin of this present study, cases of sheet rupture which occurred on deep drawn components produced in a workshop of one company during deep drawing operations. The simulation of deep drawing process on a numerical code finite elements Abaqus, has significant capabilities that are used to solve multiphysics problems. From the same model, same element library, same material data, and same load history, an Abaqus model can easily be extended to include additional physics interaction.

Thus, when a material is deformed, we notice a significant thermo-mechanical coupling, due to important plastic deformations that cause a considerable temperature rise. The simulation of such a process must take into account the influence of the physical parameters on one another.

this case, the coupling integrates two phenomena : it adds thermal deformations to the mechanical energy dissipation. Furthermore, it is no longer superficial and it no longer occurs through the boundary conditions, but it takes place in volume at any point of the piece. Although the coupling is low, the mechanical quantities (stress and strain) and the thermal ones (temperature) are highlighted in the results of the simulation that show a heterogeneous distribution of these quantities during the deformation on the entire piece. The simulation of the deep drawing process has allowed the visualization of the deformation progress and material behavior during the process. The zones with high local thinning, and the zones at the risk of a rupture, are localised thanks to the results of the simulations. The variation of certain multi-physical parameters in simulation such as the coefficient of friction and the pressure clamp of the blank, allowed us to deduce various scenarios which enabled to optimize the working conditions of forming.

Keywords: deformation, deep drawing, rupture, multi-physics simulation