E. Lamouroux

Detailed Model of Welded Joints to Simulate the Failure of Car Assemblies

University of Valenciennes (France)

Contact : eric.markiewicz@univ-valenciennes.fr

The classical methods of experimental characterization concerning the welded joints' stress carrying capacity are unsatisfying for industrial purposes due to their cost and their slowness. This work provides, for different materials and several sheet thicknesses, an alternative approach based on the construction and on the validation of a 3D solid numerical model of spot-welds and Laser welds using the finite element method. Firstly, two methods of welded joint's mechanical properties'characterization as well as damage and rupture parameters are presented. Secondly, using the material model of Gurson-Tvergaard-Needleman, the welds' behaviour under quasi-static and dynamic load cases has been simulated and compared with the experimental results. This comparison showed a satisfying correlation not only for the rupture's pattern but also for the "force vs. displacement" curve characteristic of the weld. Finally, using the Laser-weld's detailed model, two case studies are realized to estimate respectively the consequence of geometrical and mechanical imperfections on the weld's stress carrying capacity and to evaluate the "transferability" of mechanical data from a given Laser weld's geometry to another one.