
Numerical Modelling of Sheet Metal Damage

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Material behavior can be investigated from initial deformation until complete fracture using a damage model. In this article, a strategy for numerical simulation of sheet metal cutting is investigated for use in heat exchanger applications.

Previously at Alfa Laval, the material behavior until complete fracture has not been investigated by numerical simulation. However, with increasing material requirements in heat exchanger applications, it is of great importance to accurately predict material fracture. This article concerns the investigation of material damage with the purpose of predicting crack propagation and fracture of stainless steel sheet metal for use in heat exchanger applications. In figure 1, a gasketed heat exchanger is presented.



Figure 1: Gasketed plate heat exchanger [1].

Experimental observations in the form of tensile tests have been conducted and lay the foundation of a material model and a damage model. The damage model GISSMO (General Incremental Stress State dependent damage MODEL) has been used to model the fracture behavior of stainless steel in the software LS-DYNA. This work is approached using an inverse modelling technique where the experimental data is used to obtain parameter values that define the system.

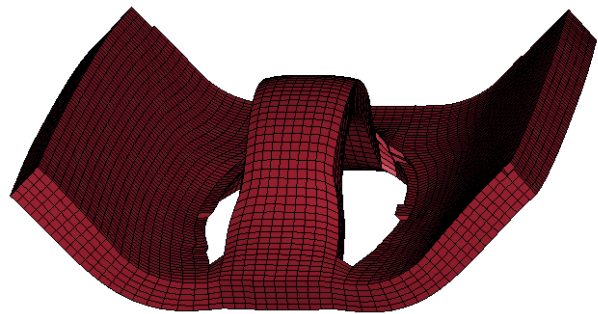


Figure 2: Example of a cut incorporated in a forming simulation.

In figure 2, an example of a punch incorporated in a forming simulation is illustrated and the results from this work can provide valuable insight into the modelling of damage and can be used in the design process of stainless steel components. The present approach to modelling of damage appears promising for future work with other materials. Issues and limitations with the present work are addressed and it is concluded that accurate experimental data is of utmost importance to assess damage and the experiments should be carefully designed for their purpose. Suggestions on how to improve the current damage model and how to approach the damage modelling of other materials is also discussed.

References

- [1] Alfa Laval. *Gasketed plate-and-frame heat exchangers*. URL: <https://www.alfalaval.com/products/heat-transfer/plate-heat-exchangers/gasketed-plate-and-frame-heat-exchangers/>. (accessed: 2023-01-24).