The prediction of formability is one of the most important tasks in sheet metal process simulation. The common criterion in industrial applications is the Forming Limit Curve (FLC). The big advantage of FLCs is the easy interpretation of simulation or measurement data in combination with an ISO standard for the experimental determination. However, the conventional FLCs are limited to almost linear and unbroken strain paths, i.e. deformation histories with non-linear strain increments often lead to big differences in comparison to the prediction of the FLC. In this paper a phenomenological approach, the so-called Generalized Forming Limit Concept (GFLC), is introduced to predict the localized necking on arbitrary deformation history with unlimited number of non-linear strain increments. The GFLC consists of the conventional FLC and an acceptable number of experiments with bi-linear deformation history. With the idea of the new defined “Principle of Equivalent Pre-Forming” every deformation state built up of two linear strain increments can be transformed to a pure linear strain path with the same used formability of the material. In advance this
procedure can be repeated as often as necessary. Therefore, it allows a robust and cost effective analysis of beginning instability in Finite Element Analysis (FEA) for arbitrary deformation histories. In addition, the GFLC is fully downwards compatible to the established FLC for pure linear strain paths.

Stichworte: Sheet Metal Forming, Formability, Non-linear Deformation history, Generalized Forming Limit Concept

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