Simulation of Thread Forming Processes

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Manufacturing of threads is more common known as a cutting process. However, threads can also be manufactured by a forming process and this process is often used in industry. However, only few simulations have been carried out, and therefore analysis of internal threads is presented.

Thread forming requires a material with good cold forming properties, in this case sheet metals for electronic products are used. A hole is drilled or cut into the sheet. For the forming of the thread, a thread former rotates and moves forward, similar to a screw. However, the thread former has an increasing diameter. With each rotation more material is displaced. By this, the thread forming is an incremental forming with compressive forming conditions.

Compared to thread cutting, the forming has some advantages. The major advantages are the avoidance of chips and the work hardening of the material. No chips have to be removed, making the process saver. But the biggest advantage of cold forming is the work hardening resulting in increased strength of the thread.

For a better insight into this process, several analyses have been carried out. As the forming causes locally very high strain, the analysis with Lagrange elements is limited. As an alternative, single material ALE and EFG approaches are used to extend the limits. Results of the different approaches are compared.

The model setup has to take into account the analysis time, as the incremental forming and the fine mesh require a high number of cycles to analyze. Tool speed, meshing and element formulation have to be adjusted to limit CPU time.

The results show the deformation and the work hardening of the sheet metal. For the presented analysis, the hole is manufactured by cutting and the diameter may change due to tolerances. The evolution of the thread due to different diameters is the major reason to perform simulations.