Presentation to the report №1011 «Simulation of Rift Element Forming by Magnetic-Pulse Deformation»

Presented By

Professor, Sc.D. Kurlaev Nikolay Vasilievich, **NSTU**
Aspirant Eng. Ahmed Soliman M. Sherif, **NSTU**

Introduction

- One of the most common operations of magnetic pulse sheet stamping is the formation of a rift and stiffeners, which are widely used in aircraft manufacturing
- Reducing labor intensity while maintaining the required quality parameters of the obtained parts is one of the most relevant issues of sheet stamping
- The solution to this problem should provide, with given tolerances on the geometric dimensions of the part, the requirements for the surface condition, strength and performance characteristics of the product
- In this paper, to study the stress-strain state of a rift workpiece in forming – drawing processes using control elements, the finite element method was used

Aims

- ✓ Studying the tensor fields of stresses and strains of a physical model, deformed by experimental equipment
- ✓ Evaluating the error in determining stresses and strains
- ✓ Determining of the limiting parameters of the stress-strain state and the parameters of the technological process corresponding to this limit state, guaranteeing the absence of rejection signs on the finished product
- ✓Stamping of stiffeners and extrusions refers to the processes of embossing. The relief of such parts, as a rule, is formed by changing the thickness of the workpiece, i.e. Forming
- ✓An example of numerical simulation of the electromagnetic forming of a rift with the obtained mesh shape of a workpiece without a corrugation defect or metal shrinkage is given by using LS-DYNA

Experimental model of rift by LS-DYNA

To create a model of the electromagnetic stamping process, the LS-DYNA program was used

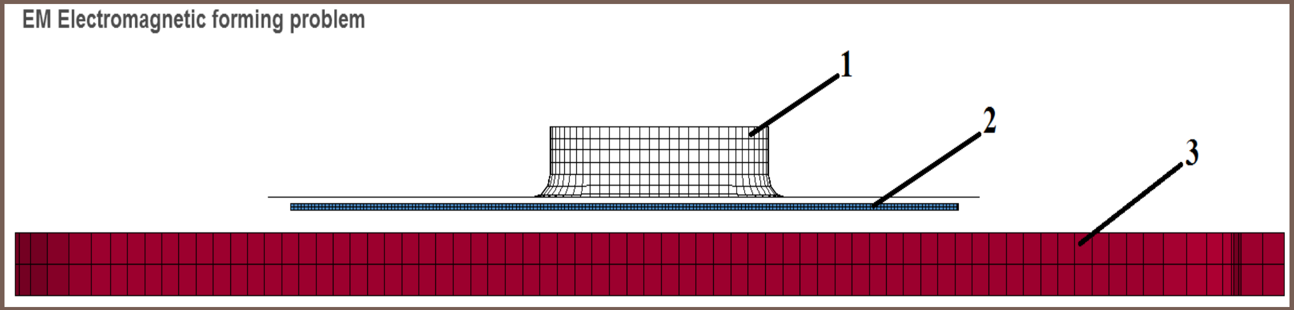

Figure 1. Scheme of electromagnetic sheet stamping: 1 – die; 2 – blank; 3 – coil.

Figure 1 shows a model of electromagnetic stamping of a rift element from a sheet of aluminum alloy D16AM. The workpiece 2 was modeled using an elastoplastic piecewise linear plasticity model * MAT_PIECEWISE_LINEAR_PLASTICITY (figure 2), in which the hardening curve is set in depending on the strain rate

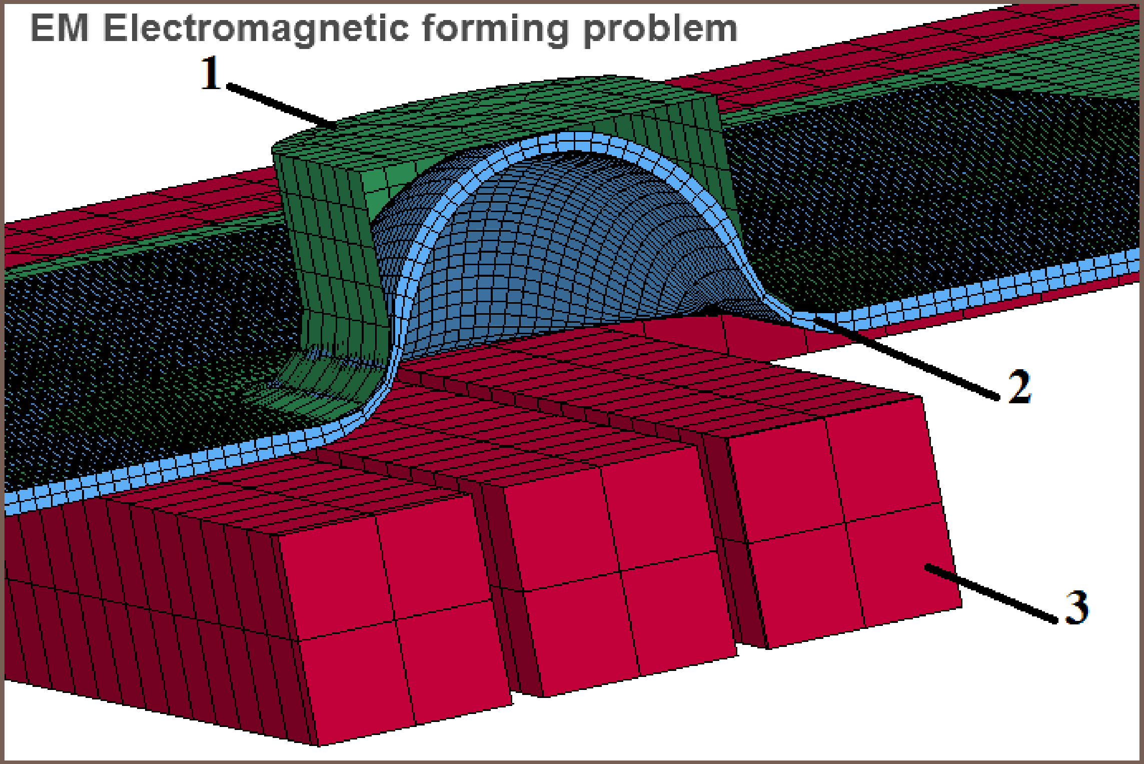

Figure 2. Cross section of a rift model: 1 – die; 2 – workpiece; 3 – coil.

For the coil and the workpiece, a hexagonal grid (solid) was built, and for the die, (shell) elements were used

Results

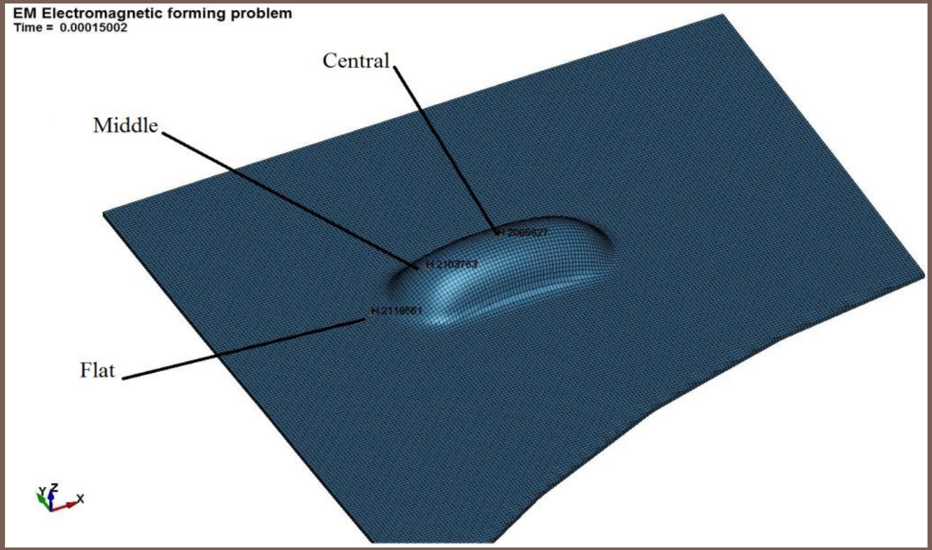

Figure 3. Formed rift with control elements.

1) Measurement of the thickness of the rift, according to the control points, showed that the greatest thinning occurs in the middle part of the rift, and the smallest thinning occurs on the flat part of the workpiece, near the rift
2) Plastic deformation was 34% in the middle zone, in the central zone of 27.5%, in the flat zone of 2.5%
3) The highest temperature is concentrated in zones of maximum deformations and for a short time reaches a value of 200 degrees Celsius.

Thanks for your attention!