

УДК 621

Tetiana Matiukhina¹, Svitlana Voitenko²

¹ PhD student, PTM Dpt., NU “Zaporizhzhia Polytechnic”

² senior teacher NU «Zaporizhzhia Polytechnic»

OVERVIEW OF MODERN SHEET METAL STAMPING TECHNOLOGIES

At the current stage of development of the machine-building industry, the share of large-scale and mass production is gradually decreasing. As a rule, consumers demand a greater variety of goods with a small batch production. Under such conditions, the competitiveness of production will be determined by the ability to launch new products in the shortest possible time at the lowest cost.

In one-off and small batch production, when manufacturing axially symmetrical parts and semi-finished products without thinning, roller rolling or rotary drawing is traditionally used with universal or special pressing equipment. However, the use of rotary methods is limited by the need for expensive power tracking hydraulic drives, electro-hydraulic copying devices and numerical control systems, or the involvement of highly skilled la-

bour when using universal equipment. With the increase in series production, the traditional multi-stage die drawing becomes more efficient.

It is possible to increase the efficiency of the technology of obtaining parts by stamping (especially in serial production) only by optimization, that is, by forming the product with the minimum possible number of main and auxiliary operations using the most simple in design stamping equipment and universal press equipment.

That is why the authors of propose to use computer modelling programmes for axisymmetric stretching processes in the DEFORM environment to predict the loss of stability of a thin sheet billet during deformation. According to the results of the study, it was found that modelling the process of pulling a thin sheet in the DEFORM 3D environment allows visualising the process of corrugation formation with a high degree of probability and thus predicting the loss of stability of the workpiece in real deformation processes, provided that deformation occurs with a relatively simple geometry of the initial workpiece and deforming tool.

Under more complicated deformation conditions, the results of a full-scale experiment and computer modelling may differ. This somewhat complicates the prediction of corrugation formation, but the problem is solved by an extended analysis of the stress-strain state and behaviour of the billet metal in the deformation zone. The appearance of areas in the workpiece where there is an unpredictable and uncontrolled loss of contact between the workpiece material and the deforming tool or areas with significant unevenness in the speed of movement of the workpiece points clearly indicates problem areas with an increased probability of corrugation formation in the actual drawing process. The use of computer modelling programmes can help to improve production efficiency.

In addition to the use of modelling programmes in modern conditions to increase productivity and reduce labour intensity and cost, elements of stamping equipment made of polyurethane are used. The authors of conducted a number of studies and found that polyurethane can be used to manufacture moulding tools, individual parts of the units for pushing finished products out of moulding cavities and units for pressing the workpiece during extraction, as well as damping devices to compensate for impulse loads. Equipment that uses an elastic medium is often ten times cheaper than special or universal rigid dies. Replacing the rigid metal parts of the dies with elastic polyurethanes has provided a number of advantages of the new polyurethane stamping process, but also revealed its disadvantages. The main disadvantage is a significant increase in the stamping force due to the need to deform both the workpiece and the polyurethane itself. The paper points out that polyurethane stretching of parts of complex configurations requires a force that is almost an order of magnitude higher than the stretching force