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TECHNOLOGICAL PROCESS AND ANALYSIS OF RADIATOR HOLDER USING SOFTWARE'S AND FEM METHOD

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ABSTRACT
Even earlier, was done the projection and processing of deformed details. Earlier, there were different design offices that did not use the technology and still have the processing of different parts. The purpose of this paper is the presentation and analysis using finite element method and application of software's in analysis and projection of radiator holder that is processed with deformation and in this case of sheet metal forming. The development of software's programs that assist in the deformation of metal with volumetric deformation has been developed much by implementing various computer systems. MEF analyzing and processing using different software, give us a clearer result in the use of software in this kind of manufacturing. The results will include advantages of software use and changing of material state during metal forming process. Design the metal forming process, analysis of the material structure will also be analyzed. The simulation of the structure will take place as the results achieved.
Keywords: Application software, radiator holder, MEF, metal forming

1. INTRODUCTION
Designing the technological processing processes with deformation of the parts worked with bending is a process that requires a great deal. The majority of the processes are simplified with the advancement of technology and is facilitated. Design accuracy as an important factor has also been shown to be achievable. So far, various authors have conducted research on the state of the material during processing and have achieved the results in a certain form. Bending of sheets and plates is widely used in forming parts such as corrugations, flanges, etc. Bending is a forming operation in which a sheet metal is subjected to bending stress thereby a flat straight sheet is made into a curved sheet[1].

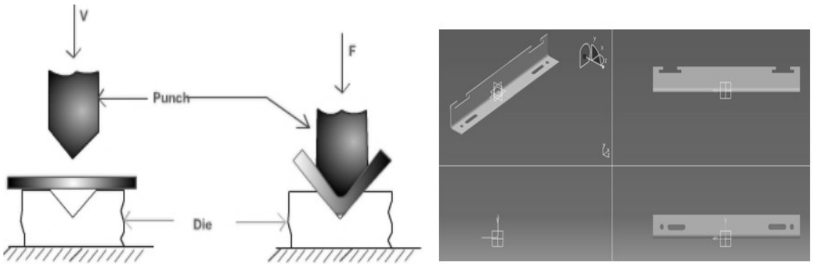

Figure 1. V- Bending (Radiator holder)

2. LITERATURE REWIEV
In modelling and simulation, models are generally developed first. A model of a real system represents the system physically or virtually from the perspective of the phenomena or behaviours of the real system to be explored and investigated. A model is similar to but generally simpler than the

real system it represents, while abstracting and approximating most of the same salient features of the real system as close as possible [2]. The use of Finite Element Method (FEM) of the deformation parameters calculation is constantly being enhanced by the increment of simplicity of usage, development of advanced software, reducing a time for the preparation of input data and obtaining of a wide spectrum of output information [2]. Due to a rapid computer technique development, a numerical approach to solving problems has been adopted lately. The Finite Element Method - FEM has been used as the might's numerical method, more commercial software packages for numerical bulk deformation process simulation have been made [3]. Manufacturing and the basic entity of the manufacturing process model is intuitively understood as an activity, usually planned in advance, with all necessary attributes. All manufacturing planning functions generate various planned tasks or activities (e.g., cutting with turning cutter, deforming with a press, machining on a single machine, processing job order, etc.) [4]. Developments in Computer Integrated Manufacturing have focused for a long period of time in linking various automated activities within the enterprise[5]. Software's like CATIA enables the creation of 3D parts, from 2D sketches, sheet metal, composites, and moulded, forged or tooling parts up to the definition of mechanical assemblies. The software provides advanced technologies for mechanical surfacing & BIW. It provides tools to complete product definition, including functional tolerances as well as kinematics definition. CATIA provides a wide range of applications for tooling design, for generic tooling, mould & die. In the case of Aerospace engineering an additional module named the aerospace sheet metal design offers the user combine the capabilities of generative sheet metal design and generative surface design [6]. The most important numerical method is the method of finite elements (FEM). Numerous finite element programmes have been developed which are able to solve linear, non linear, static, dynamic, elastic, plastic, elastic – plastic, steady state, transient, isothermal as well as non isothermal problems[7].

3. TECHNOLOGICAL PROCESS OF RADIATOR HOLDER USING SOFTWARE

During the design of technological processes we have to bear in mind that the materials we use are utilized in maximum. The economicity of sheet metal that is used should craft a special place[8]. Here economicity is calculated for two cases, here in the first case the cut of sheet metal is made in longitudinal direction (sheet metal with dimension 2000 x 1000 mm) and in the second case the cross-section of the same sheet metal will be done.

3.1. Calculation of the economicity of the use of specific sheet metal

First, we will calculate the economic use of the sheet cutting form.

Case 1:

$N_1 = 1000 / V = 1000 / 83.2 = 12.01$ - we adopt $N_1 = 12$ pieces

$N_2 = 2000 / V = 2000 / 366.6 = 5.45$ - we adopt $N_2 = 5$ pieces

$N_3 = N1 * N_2 = 12 * 5 = 60$ pieces

$V = la + e = 80 + 2 * 1.6 = 83.2$ [mm]

$V = la + e = 365 + 1.6 = 366.6$ [mm]

Case 2:

$N_1 = 1000/V = 1000 / 368.2 = 2.71$ - *adopt* $N_1 = 2$ pieces

$N_2 = 2000 / V = 2000 / 81.6 =24.5$ – *adopt* N2 = 24 pieces

$N_3 = N_1 * N_2 = 2 * 24 = 48$ pieces

$V = la + e =365 + 2*1.6 = 1168$ [mm]

$V = la + e = 80 + 1.6 = 81.6$[mm]

Where are: V - The width of the ribbon together with the additional side parts, l_a - the length of the piece, e- Edges removed from the part being used, N_1 - the number of details on the sheet metal sheet, N_2 - number of ribbons in the table, N_3 - the number of detail on the sheet metal:

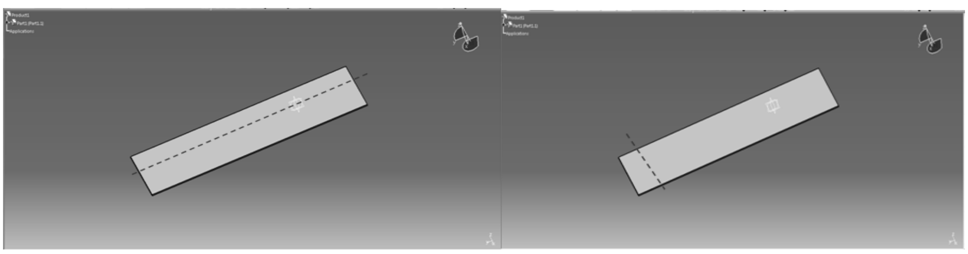

Figure 2. Economicity of sheet metal use

3.2. Technological process of radiator holder

At this point, the design steps of the holder have been expedited until the end of the processing process, so the processing path is presented starting from designing, cutting, stretching and bending.

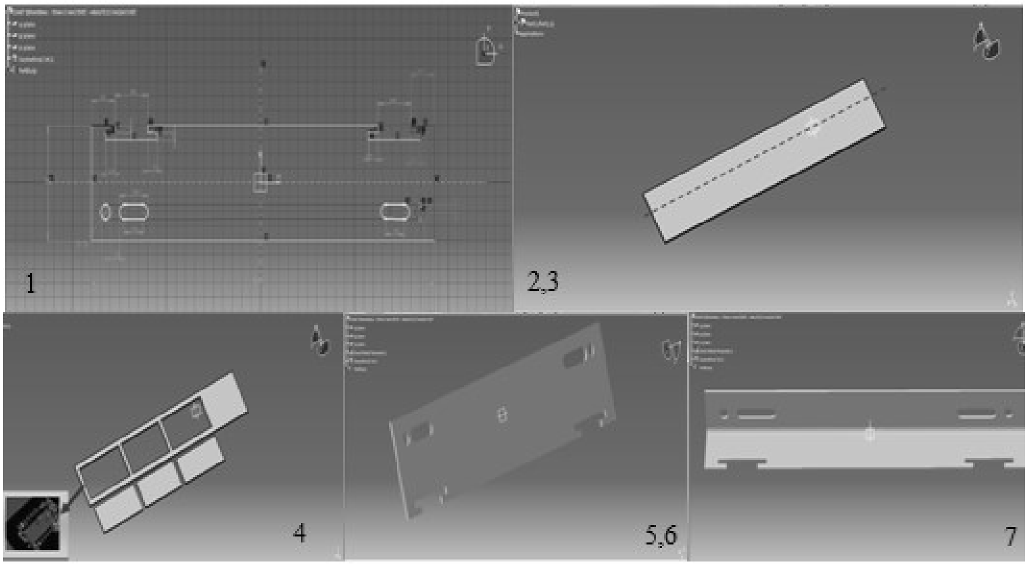

Figure 3. Projection into stages

3.3. FEM analysis of radiator holder

The term simulation is derived from the Latin word “simulare” what means “to pretend”. However, the technical meaning of simulation is the description and reproduction of physical and technical processes by use of mathematical and physical models [9]. As a demonstration of the feasibility of the plastic bending of radiator holder analysis, application of the FEM method has been made to some elementary mesh, but representative sample structures of material change are presented. So in this point of the analysis new simulation job is created. Created part and mesh after load action is given in figure 4.

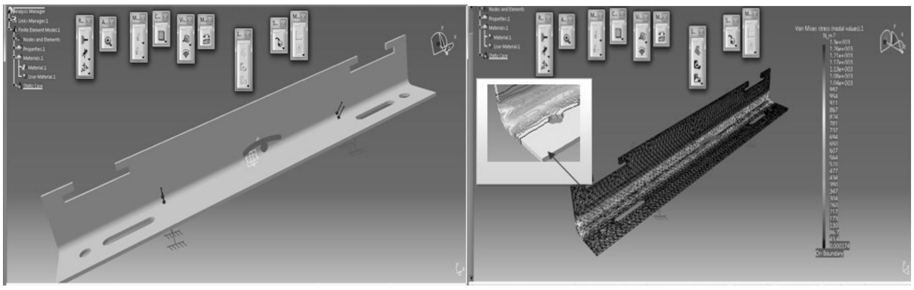

Figure 4. Created radiator holder and MESH creation

For analysis is used material St 52-3 in JUS standard is marked with Č. 0563 with these characteristics.

Table 1. Characteristics of material in outside temperature

Elasticity module	E [N/mm^2]	$2{,}1\cdot10^5$
Density	ρ [kg/dm^3]	7,80

Table 2. Material property and deformation in different axis

Material	User Material.1 : Steel	Value	Dof	Node	x (mm)	y (mm)	z (mm)
Young's modulus	210N_m2	5.3795e+006	Tx	3029	-5.4447e+001	-1.4286e+000	2.1879e+001
Poisson's ratio	0.3	7.8902e+006	Ty	1781	1.1728e+002	1.3127e+001	0.0000e+000
Density	7880kg_m3	8.2651e+006	Tz	1954	1.8302e+002	-1.2500e+000	3.7249e+001
Coefficient of thermal expansion	0_Kdeg	9.9657e+006	Ty	999	1.1793e+002	7.8815e+000	2.5000e+000
Yield strength	0N_m2	1.0128e+007	Ty	3050	5.9160e-001	3.4240e+001	1.4141e+000
		1.0204e+007	Tz	3050	5.9160e-001	3.4240e+001	1.4141e+000

In the following figure are presented Von Misses stresses on the finished part of figure 4 and the relevant strains on the radiator holder. The residual stresses can be computed using many different methods using numerical, analytical or experimental methods such as layer removal, curvature, neutron, X-ray diffraction and etc [10]

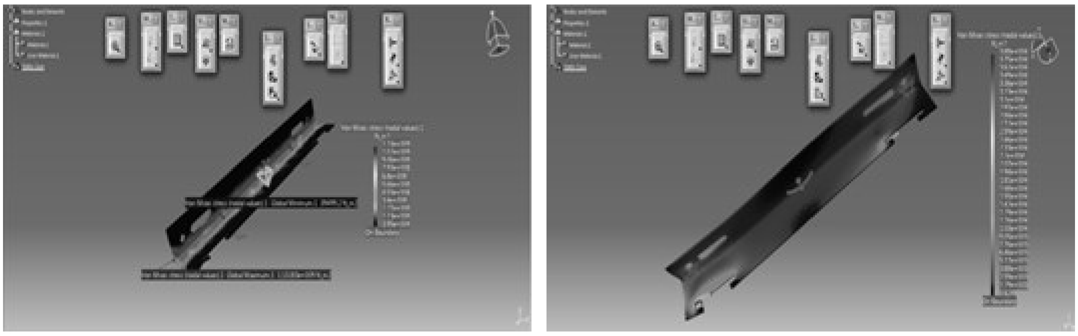

Figure 5. Von Misses stresses

4. CONCLUSION

The use of software in designing of technological process of the radiator holder in addition facilitates design work and also increased the design speed. It is apparent that the use of the first case is more appropriate for the economic cut of sheet metal. On the other hand, the use of CAD/CAM systems in designing technological processes is intended to make work easier and the advantages of using these systems are to yield good results such as: reducing the professional level of the designer, reduction in design time, lower design and production costs, the possibility of realization of technological methods of the same quality level, and use of more rational technological methods and increased production. Simulation of results with the help of CATIA software indicates that using simulation software facilitates the work that would be presented during design. This is because the impact of the material situation can be seen after the actions of the forces. The results obtained may indicate whether or not that part can be processed.

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