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INFLUENCE OF CUTTING SPEED ON THE QUALITY OF BLANKED PARTS

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ABSTRACT
The present paper covers and describes the influences of speed cutting on the part edge quality of blanked parts. Experiment shave been conducted using different material, punch die clearances and different cutting speeds. In order to determine the reachable cutting speeds and calculate the energy required for blanking, velocity stroke cures were obtained.
The quality of the part edges shows that higher cutting speeds can improve the part edge quality, resulting in smaller burr height and rollover, and a larger shear zone. Furthermore, it could be observed that the part quality improvement when blanking with high cutting speeds is much more distinct for stele than for copper or aluminum. According to blanking theory, this improvement was expected because copper and aluminum have much higher heat conduction coefficients. Therefore, the at dissipates faster and the desired stress relief effect does not take place to the same degree as for stele.
Keywords: experiments, quality, speed, blanking.

1. INTRODUCTION
The content of this article offers some solutions based on knowledge and numerical methods for simulation and analysis of real problems that occur during the blanking and punching process which can be found very often in industrial processes. If further, the technology of the sheet processing seen in the traditional way then we are having with the reproduction of outdated processes and methods which did not offer to us advantages in the market. Therefore, if IS achieved full integration of numerical FEM methods and if are applicated powerful CAD software's then its provided to us conditions and real competitive advantages for solving various problems in the metalworking industry.
By using MSC Marc software's that uses the finite element method, is made an analysis of strain and elastic deformations of the tool leading position, with the help of which may be indicated and provided for possible damages and eventual tool breaking.

2. THE EXPERIMENTAL TESTS AND THE ANALYSIS OF THE OBTAINED RESULTS
In order to complete the accurate analysis of the blanking process there are realized a lot of experimental tests which have the duty to confirm the results that are obtained and attitudes in order to facilitate the research work to reach conclusions from the obtained results.

2.1. The machines and the tools for realizing the experimental analysis

The first round of the experiments was realized in eccentric presses, with nominal force of 250 [kN], and the nominal foot from 6 to 60 [mm]. The second round of the experiments was realized in the hydraulic presses, with very high nominal force of 1200 [kN]. Besides the variable space, in order to make a comprehensive review was done the changing of the relative speed of the penetration of the upper tool elements.

Figure 1. The experimental tool located in the eccentric and hydraulic presses with the equipments for the presentation of the force and the working foot.

2.2. The equipments for analysis and for the processing of the results

To measure the strength was used the HBM (Hottinger Baldwin Messtechnik) force meter in the range of 0 to 500 [kN], the full bridge Winston, which is located below the upper tool, around the special socket for connection with the upper blade, with the help of which will be transferred the deformation force during the punching process.. The measurement of the road is made through inductive provider of the road, ranging from 0 to 100 mm of the Winston bridge which during the process is also connected to the upper mobile blade.

Figure 2. The Hottinger Messtechnik Measurer

Figure 3. Input datas in catman® sofware

For the analysis and for the processing of the results was used a software solution called HBM Catman, and for absorption of the measured sizes was used SPAIDER which has the possibility of simultaneous measurement of 8 physical sizes, where it is possible to be forwarded the time, in the zero channel is the giver of the road while in the first channel the giver of the deformation force.

2.3. The results of the experimental tests

The experimental tests to review the difference of the maximum force is examined in order to change the speed of the punching and to change the workspaces of the tool elements. In the addition of the paper we will make the presentation of the obtained results of the force differences depending on the speed of the working elements of the tool and the space between them.

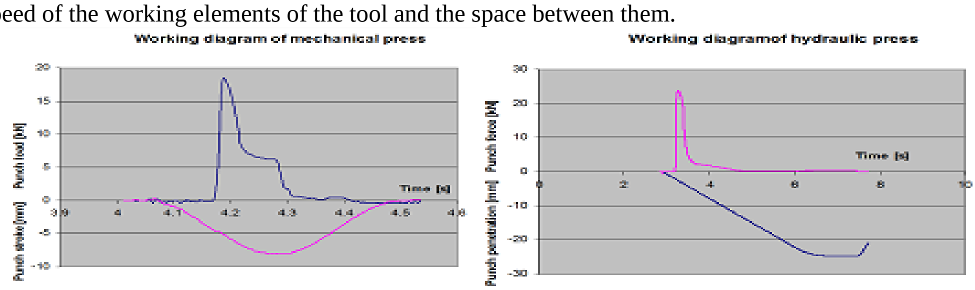

Figure 4. Dependence of the force and the working foot during the punching of the Aluminum of ∅35 for real time in the eccentric presses for the space of 0,06 mm, Al44m

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To consider the speed of the deformation the tests were realized out in hydraulic presses where the force difference of the deformation is forwarded to a very small speed of the mobile tool elements. There are performed four series of measurements of four tests for both types of the material in the blanking tool of ∅35 mm. Tests were performed for different speeds from 500 [N / s] to 1000 [N / s].

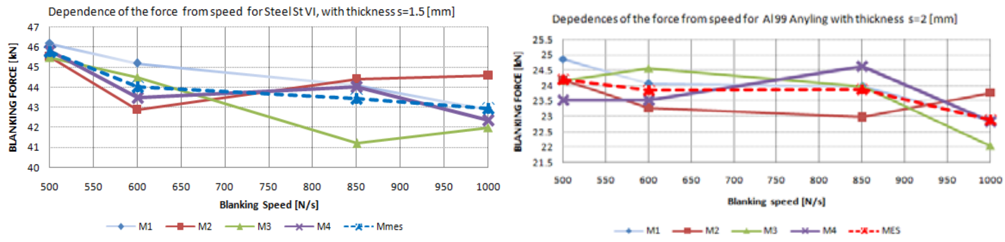

Figure 5. Dependence of the force from the speed in real time during the punching of the Aluminum of ∅ 35 mm in the hydraulic presses for the space of 0,06 mm

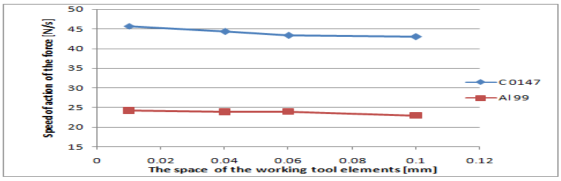

Figure 6. Dependence of the force from the speed and the space of the working tool elements for both types of the material

Table 1. The results of the experimental measurement for steel St VII and Al 1999

Speed [N/s]	500	Rm[N/mm2]	600	Rm[N/mm2]	850	Rm[N/mm2]	1000	Rm[N/mm2]
M1[kN]	24.87	150.73	24.08	14.59	24.00	145.45	22.87	138.61
M2[kN]	24.2	146.67	23.27	14.10	22.97	139.21	23.76	144.00
M3[kN]	24.16	146.42	24.57	14.89	23.98	145.33	22.05	133.64
M4[kN]	23.53	142.61	23.53	14.26	24.62	149.21	22.84	138.42
Mmes[kN]	24.19	146.61	23.86	14.46	23.89	144.80	22.88	138.67
Speed [N/s]	500	Rm[N/mm2]	600	Rm[N/mm2]	850	Rm[N/mm2]	1000	Rm[N/mm2]
M1[kN]	46.20	280.00	45.20	27.39	44.10	267.27	42.90	260.00
M2[kN]	45.53	275.94	42.90	260.00	44.40	269.09	44.60	270.30
M3[kN]	45.50	275.76	44.50	26.97	41.20	249.70	42.00	254.55
M4[kN]	45.80	277.58	43.50	26.36	44.02	266.79	42.35	256.67
Mmes[kN]	45.76	277.32	44.03	26.68	43.43	263.21	42.96	260.38

3. MODELING AND THE NUMERICAL SIMULATION OF THE BLANKING PROCESS IN FUNCTION OF THE SPEED

Modeling and simulation provides numerous opportunities in solving various problems in the processing process. At this level of must seen the material structure and is created the nonlinear FEM model in the cutting field, it is clear that it is a fundamental issue. In this paper is defined and presented the simulation methodology of the material flow into the manufacturing processes in the real models. The presented methodology is implemented successfully with the creation of the model for simulating of the blanking process in a satisfactory degree of deviance in relation to the real model. The performance of the simulation experiment is fully described in the process of the material flow, and serves as a basis for expanding of the research scope.

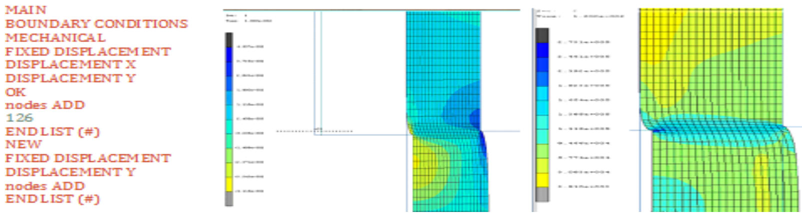

Figure 7. Distribution of the strain in the structure of the material according to von Mises's after incrementation no. 2

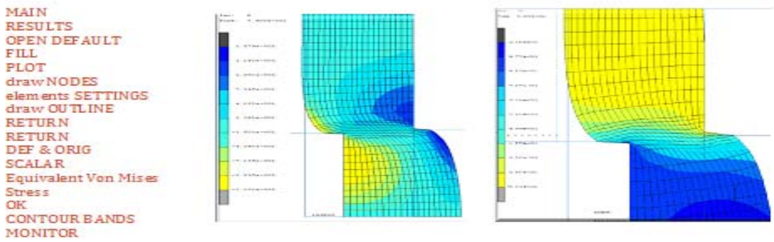

Figure 8. Replacement according to the structure of the material in the direction of x axis after the incrementation no. 10

4. CONCLUSION

Based on the research results, it can be concluded that the speed of the deformation significantly affects the reduction of the blanking - punching force. The researches also shows that increasing the speed of blanking - punching process to a certain value, the maximum force will increase, so then this speeds will reduce. In other words, by increasing the speed of the blanking - punching process to a certain amount the force increase is not linear and affects to the tool lifespan, therefore we must be careful in determining the optimum speed and the working spaces in blanking - punching process. In this paper, a numerical model to simulate blanking and consequently predict the cut edge profile of the blank was presented. An adaptive remeshing, rezoning and discrete crack propagation techniques were implemented in a commercial finite element software MSC. Marc® .

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