COMPUTER CONTROLLED EXPERIMENTAL DEVICE FOR INVESTIGATIONS OF TRIBOLOGICAL INFLUENCES IN SHEET METAL FORMING

Milan Đorđević[1,*], Srbislav Aleksandrović[1], Tomislav Vujinović[2], Milentije Stefanović[1], Vukić Lazić[1], Ružica Nikolić[1,3]

[1] Faculty of Engineering, University of Kragujevac, Manufacturing engineering department, Sestre Janjić 6, 34000 Kragujevac, Serbia

[2] Starog Vujadina 47 D, 78000 Banja Luka, RS, Bosnia and Herzegovina

[3] Faculty of Civil Engineering, University of Žilina, 010 26 Žilina, Slovak Republic

[*] corresponding author: e-mail: omdlab@kg.ac.rs

Resume

Sheet metal forming, especially deep drawing process is influenced by many factors. Blank holding force and drawbead displacement are two of them that can be controlled during the forming process.

For this purpose, an electro-hydraulic computerized sheet-metal strip sliding device has been constructed. The basic characteristic of this device is realization of variable contact pressure and drawbead height as functions of time or stripe displacement. There are both, pressure and drawbead, ten linear and nonlinear functions. Additional features consist of the ability to measure drawing force, contact pressure, drawbead displacement etc.

The device overview and first results of steel sheet stripe sliding over rounded drawbead are presented in the paper.

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1. Introduction

Technology of deep drawing of thin sheet metals is very important in modern industry. Due to the development of new materials of more complex formability and raising of the technological requirements to the higher level, the need for realisation of complete control of forming process increases. In order to succeed in that, out of a large number of influential factors, it is necessary to identify, the ones which can be changed and controlled throughout the forming process. There are only two such factors: contact pressure on flange and drawbead height [1].

The process control through active, intelligent complex systems requires constant dynamic feedback between the given goal function, controlled and controlling variables [2]. The goal functions and controlled variable can be different: wrinkle height, thinning in the critical zone, flange motion, flange thickness change, friction force, forming force, tension stress in work piece wall, etc. The given objective functions are defined either by computer simulations or by previous experiments. Pressure on flange and the drawbead height present the controlling effects. High reacting speed to controlled values change and robust controlling hardware and software apparatus are required, which all implies significant investments [2 - 4].

There is also an alternative – a much simpler approach – in a way used in this paper. However, first it is necessary to define optimal functions of pressure and drawbead height according to proper criteria (drawing depth, piece quality, forming force, tension stress etc.). This often requires comprehensive experiments [3, 4] in order to identify the character of specified factors influence. With such information, it is possible to form the controlling apparatus for practical application whose main goal is to realise previously defined optimal functions of pressure and drawbead height. Such equipment