

# THE DETERMINATION OF THE OPTIMAL VALUES FOR SOME PARAMETERS IN DEEP DRAWING OF CYLINDRICAL CUPS WITHOUT A BLANK HOLDER

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**Abstract:** *This article investigates the influence of the die punch clearance, the average velocity in the active stage and the lubrication on the deep drawing quality expressed by the thickness evenness on the finished product surface. In order to minimize the number of experimental trials, a fractional factorial design was developed together with an orthogonal array, thus analyzing the contribution of the three parameters under study to the quality of the deep drawing process. Using TAGUCHI's signal-to-noise ratio, we determine that ram velocity has a major influence, followed by the clearance between the active elements, while the contribution of lubrication is low. The results of the research are useful in developing a sensible design of experiments.*

**Keywords:** *die punch clearance, average velocity, lubrication, experimental trials programme with orthogonal array*

## 1. Introduction

Deep drawing is one of the most important processes for forming sheet metal parts. Besides its importance as a forming process, cup drawing also serves as a basic test for the sheet metal formability.

The Taguchi method is based on the conception of the Japanese specialist having the same name regarding the improvement of the quality. The Taguchi's major contribution consists in combining the engineering techniques and the statistic ones in order to achieve the rapid improvement of the quality costs, looking for the optimization of the product design and of the fabrication processes. The Taguchi's experience plans contributed to the Japanese's success in the quality field, which permitted them to become, for more than 20 years, the world leaders of quality [1, 4, 14].

Researches were based on the use of the Taguchi method for determining the influence of deep drawing parameters. This method was used to identify the relative influence of each parameter of the process taken into consideration

The superiority of the Taguchi method comparing to the traditional experience design method, resides in the use of the performance indicator: Signal-to-Noise ratio. This Signal-to-Noise ratio considers simultaneously [1,2,5]:

- The desired value (Signal), to be achieved;
- The undesirable variability of this value (Noise), to control.

The essential difference between the traditional approach and Taguchi's consists in the way in which the influence of noise is considered. The traditional approach aims at eliminating the noises, which is usually expensive and sometimes impossible.