



Design of combination tool for an automotive component with process optimization in metal forming

Harshal A. Chavan¹ · Vijay P. Wani²

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Abstract

Selection of the tool and manufacturing equipment are the important phases of the process design in metal forming industry, as the tool development is very vital task in metal forming. The present work is focused on design and development of new combination tool used to perform three operations simultaneously on the hollow rod. The rod is used to connect the recliners of an automotive seat. A combination tool is designed based on the standard tool design approach and replaces old tools used for three different operations. A tool is used for manufacturing of a rod, which undergoes total five operations for the final product. The process has been optimized by combining three operations simultaneously in a single stroke, which ultimately increases the productivity. The study includes designing of the components, analyzing displacement and stresses for combination tool to use on the available press machine. Various forces occurred on the combination tool has been calculated and the test is carried out on an available press machine. The results found satisfactory with less defective components and improvement in productivity compared to the previous tool.

Keywords Combination press tool · Interactive approach · Tool design · Force distribution · Productivity improvement

1 Introduction

Design and development of combination tool for the sheet metal part is one of the crucial phase in sheet metal manufacturing, as for mass production, forming technology will be essential [1]. Forming industries generally uses past experience and internal techniques for tool design. The study has validated that, with the aid of CAD ability and tool designer's experience, process can be optimized by developing a combination tool. To manufacture precision tool in less time and at a lower cost is the main benefit of computer-aided engineering for combination tool design [2]. The existing system of manufacturing causes imperfect parts and rework, which results in higher cost of manufacturing, lower output and customer displeasure due to an extended production lead-time of the

component. The process is carried out for manufacturing the connecting rod, used to connect recliners to regulate driver and co-driver seat in an automobile. The process consists of total five operations in sequence as grooving, flattening, serration, crimping and ID enlargement. A single tool is made for performing first three operations simultaneously.

In the earlier process chances of product quality response to process discrepancy was more. The proposed work aims to find an optimum process required for the operation and minimize the lead-time. Design of press tool used in thresher blade along with modeling, stress analysis and displacement of the component was carried out and found that fixture controls the orientation and location of parts in an assembly [3]. It appreciably supplies to process capability that determines product quality and production yield. A number of approaches developed to optimize a fixture assembly system with stiff fixture layout to deformable parts fixture layout [4]. Generation of the elegant progressive design system is the best way for cost effective product design [5]. It is demonstrated that three dimensional vision and part drawing helps the user to plan and develop the tool. The basic tasks of the process design is to select the sequence of operations and type of tools to be design [6]. To guide developments in engineering design processes and produce more valuable products,

✉ Harshal A. Chavan
chavanharshal@gmail.com

Vijay P. Wani
vpwani@gmail.com

¹ Mechanical Engineering Department, MET's IOE Bhujbal Knowledge City, Nashik, Maharashtra 422003, India
² MET's IOE Bhujbal Knowledge City, Nashik, Maharashtra 422003, India