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Performance Analysis of Dual Hydroforming Process by Using the Finite Element Method and ANN :- A REVIEW

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***Abstract*— -The hydroforming process for tubes has gained increasing attention in recent years. Coordination of internal pressurization and axial feed curves is essential in the pipe hydroforming process to generate successful parts without cracking or crumpling. The state of stress at any given time and place will vary depending on the history of the process and the design and control of loading routes. A parametric process include back pressure, is introduced to achieve a favourabletriaxial stress state during the deformation procedure this is known as dual hydroforming. The advantages offered by dual hydro forming will be characterized according to the amount of thinning of the wall, the limit of plastic instability and the final bulged configuration. A geometrical model is developed to analyse the state of stress and deformation in the tube during the dual hydroforming process. The effect of applying back pressure on the thin-walled tubes with a combination of internal pressure and independent axial load is considered. A parametric study was conducted to investigate the effectiveness of the conditions of the dual hydroforming process..**

Keywords*— Induction Motor Faults, Fault Detection, Rotor Fault Analysis and Identification, Broken Rotor Bar, Artificial Neural Network and Diagnosing Techniques. etc.

I. Introduction

Induction The hydroforming of tubes has been known since the 1950s. The hydroforming of tubes has been called by many other names, such as liquid bulge formation, bulge formation tubes and hydrostatic pressure forming, depending on the time and the country in which it was used [1]. The tube hydroforming has developed in last decade into a practical method for the production of complex auto parts and an indispensable manufacturing technique. Hydroformed tube parts have improved strength and rigidity, lower tool costs, fewer secondary operations and tight dimensional tolerances compared to stamping processes, which lowers the overall manufacturing costs [1]. The success of the hydroforming process for tubes depends on a suitable combination of load curve (internal pressure and axial feed at the tube end), material properties and process conditions. One of the main concerns is to control the deformation process to maximize the expansion so that more complex shapes can be obtained. Similarly, a more resistant, less heavy, less conformable, or less expensive material can be used for a given shape.

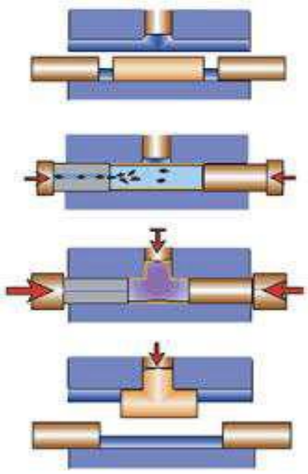

Figure 1.1: Tube hydroforming process

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The operation process for a tube hydroforming is as followed as showed in Figure 1.1.

A. The hydroforming tube is placed between the attached dies. A clamper is used tclose the dies and apply sufficient force.
B. The tube is filled with hydraulic fluid to provide the required internal pressure. Axial punches are used for initial sealing to avoid pressure losses.
C. The fluid pressure in the tube increases after the nozzle is closed to create the necessary load while using an axial feed to force the material into the deformation load zone. The right combination of axial feed and internal pressure is applied during the hydroforming process to improve hydroforming capabilities. As soon as the tube touches the die, the calibration phase begins. No axial feed is required during the calibration phase. The tube is subjected to high pressures to form corner radii.
D. Finally, the hydroformed tube is removed from the matrix.

II. LITERATURE REVIEW

In Hydrostatic forces have been successfully used in many manufacturing techniques such as hydroforming sheet metal, deep drawing, wire drawing, extruding, etc. During the deformation, the limit deformations depend on the degree of hydrostatic stress [2]. A high hydrostatic pressure suppresses the growth of cavities and thereby delays the break [3]. There is a loss of density due to the growth of micro porosity while the strip is being

drawn, and Rogersand et al. investigated the influence of the superimposed hydrostatic pressure on the reduction in density loss [4]. The results showed that stretching at the highest-pressure level increased the density, presumably by closing existing pores formed during the previous treatment. Formability problems could be minimized if all stress components could be kept under pressure. Materials with very limited formability can be extruded successfully if the billet and nozzle exit areas are under high hydrostatic pressure [2]. Hosford and Caddell [2] have shown that moderate stress and high stress generally increase or decrease together. Cockcroft and Latham [5] proposed a fracture criterion that links the dependence of the fracture stress with the hydrostatic stress. They carried out tensile tests under superimposed hydrostatic pressure for various materials. They reported that significantly larger strains of final separation were observed in some cases. Other fracture criteria have also been proposed [6, 7, 8] that identify the stress dependence of hydrostatic stress.

back pressure has been used effectively in many manufacturing processes to improve manufacturing capabilities. The most notable work in connection with the back-pressure approach is the investigation of the hydroforming of sheets (Finckenstein [9],Thiruvarudchel [10], Altan [11], Hein [12]). Back pressure has been suggested to removewrinkles and prevent fractures. Liu et al. [13] evaluated the formability of the film with a dome test to form viscous prints. Based on the proposed critical damage criterion and experimental results, it was found that the stretched film's adaptability to the viscous pressure was greater than that obtained with a solid hemispherical stamp. In their article, the feasibility of using back pressure was discussed but not implemented. What and. Al. [14] used the upper limit and lower limit approach to develop load paths for the formation of a hemispherical strain. The stamp deforms the part by pressing it against a liquid under controlled pressure. The deformation geometry of the hemispherical strain formation is comparable to that of the post in the free bulge of the tubes. Yossifon [15, 16] developed analytical models to predict the results of deep drawing. It has been shown that a pressure load path between the upper (causing break) and lower (causes wrinkle) limit can be identified and recommended for practical use. Ahmed and Hashmi [17] simulated the formation of bulge in a circular plate by exerting a central load on three central elements on the top. The restricted formation resulted in a better configuration than the conventional bulge formation. The documents presented by Nakagawa [18] and Amino [19] summarize the various advantages and applications of deep drawing hydraulic back pressure. Industrial applications of the process have also been demonstrated. To successfully hydroforming the tubes, bulge must occur without causing instabilities such as breakage, suffocation, twisting or buckling. Excessive pressure without sufficient axial feed will break the tube, while excessive application of axial force will deform the tube. As shown in Figure 1.1, the counterforce was therefore used in significant T-shaped areas and Y-shaped bumps, which make it possible to increase the internal pressure beyond the critical value [20]. Tonghai [21] has reported that the use of a counterforce in the elastomer formation process increases the protrusion height that can be achieved by 1.5 times the original diameter for steel tubes. low carbon, while the rate of expansion was 1.2 without counterforce. Koc and. Al. [20] presented several applications of counter load. The ultimate goal of THF is to get a better part without causing instability. The failure point of the failure can be avoided by controlling the tension rather than providing the axial force that can cause wrinkles. As discussed above, in some cases, such as the axially symmetrical bulging, the opposite force cannot be applied due to inherent stresses

III. CONCLUSION AND FUTURE SCOPE

The From the above tables and previous Chapter graphs, it is found that Time, Total Penetration, Total applied Pressure, Total Deformation, Directional Deformation, Equivalent Stress, Equivalent Elastic Strain, & Equivalent Plastic Strain for dual hydroforming process is well predicted by the Artificial Neural Network modal.

Hence, Artificial Neural Network model is a good tool of MATLAB to predict the Different performance characteristic of any working mechanical model.

On the basis of the current work, it is concluded that:

1. Any Performance parameter can be efficiently predicted by the Artificial Neural

Network Analysis.

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2. On the basis of Artificial Neural Network Analysis, as compare to applied force and internal pressure material properties are more responsible for proper dual hydroforming process.

3. Ansys is efficient Software to analyse the performance of Dual Hydroforming Process and results accuracy is totally depends upon the perfection of the boundary condition.

4. The prediction made using proposed model shows a high degree of accuracy for Total Deformation of Dual Hydroforming Process obtained through model 99.99%.

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