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A review- Effect of drilling process parameters on thrust force

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ABSTRACT

Drilling is one of the most common manufacturing processes in various industries like Automobile industry, Aerospace industry, Watch manufacturing industry, medical industries and semiconductors. It plays an important role for quality of manufactured product. For assembly of a product drilling, boring, reaming process are used. Many input drilling parameters are feed rate, spindle speed, drill diameter, cutting fluid, depth of cut, work piece material, tool material, helix angle, point angle, clearance angle, types of tool, etc. The performance parameters for drilling are Material removal rate, surface roughness, thrust force, torque, tool life, etc. This paper illustrates a literature review on effect of drilling process parameters such as feed rate, drill diameter, spindle speed on thrust force. The thrust force is calculated by the force sensor or dynamometer. In this paper it studied that the feed rate and spindle speed are the significant factor for the thrust force.

Keywords: Drilling process, input process parameters, thrust force

1. INTRODUCTION

Drilling is a cutting process used for producing a cylindrical hole in a solid work piece with the help of rotating tool called drill bit. Drill bit is rotated by the help of rotation of motor and through the feed mechanism the drill bit is strike on the work piece thus through these two mechanisms, unwanted material is removed. To fulfill the customer needs we need to manufacture a product with good quality at a low cost for this we need to understand the effect of thrust force on input parameters (such as drill diameter, spindle speed, feed rate, point angle) of drilling process. The Drilling output parameters are material removal rate, surface roughness, thrust force, torque, tool wear rate, tool life, etc. In this paper thrust force is taken as output parameter. To find out the thrust force a sensor (dynamometer) is connected to the work piece. Through the literature review we find out the variation of output parameters with the input parameters.

2. LITERATURE REVIEW

M Sundeep, M Sudhahar et al. [1] have presented a paper on “Optimization of Drilling parameters on Austenitic stainless steel (AISI 316) using Taguchi’s methodology”. In this paper the input parameters are Spindle speed, feed rate and drill diameter were taken and the output parameters are surface finish, material removal rate and thrust force. To perform the experiment Taguchi L9 array was used. From the paper it shows that the cutting speed increases the thrust force also increases.

Tamilselvan and Ragyraj et al. [2] have presented a paper to investigate the effect of drilling parameters on thrust force and circularity of the hole during the drilling of Ti-TiB composite. To investigate the percentage contribution and response of the parameters analysis of variance (ANOVA) is used. In this paper the input parameters are drill diameter, spindle speed and feed rate were taken. The result shows that the feed rate and spindle speed affects the thrust force. The thrust force decreases as the spindle speed is increases.

Suleyman Neseli et al. [3] have presented a paper on optimization of drilling parameters on steel (AISI 1040) using Taguchi method. Input parameters are cutting speed, feed rate, helix angle and thrust force, torque is considered as output parameter. To investigate the influence of parameters analysis of variance (ANOVA) was used. The result shows that the feed rate is the significant factor that affects the thrust force while cutting speed affects the torque.

Naseer Ahmed et al.[4] have presented a paper on effect of drilling parameters on thrust force and torque. In this paper AISI 2080 material was used. Cutting speed and feed rate is considered as input parameters. As the cutting speed and feed rate increases the thrust force is also increases.

Sonbaty et al. [5] has presented a paper on drilling parameters affecting the machinability GFR/epoxy composites. The rotational speed is constant and the input parameters are drill diameter and feed rate were taken. Torque and thrust force are the output parameters. As the drill diameter and feed rate is increases, the thrust force and torque is also increasing.

C.C. Tsao et al. [6] have performed on the evaluation of thrust force and surface roughness in drilling of composite material using regression analysis. The input parameters are considered to be spindle speed, feed rate and drill diameter. Feed rate and spindle speed are the dominant factors affects the surface roughness while drill diameter and feed rate affect the thrust force.

Lin and chen et al. [7] have performed on the effects of cutting speed on drilling of CFRP. Cutting speed act as input parameter and the output parameters are Drill wear and thrust force. The result shows that with increasing the cutting speed, drill wear and thrust force is also increases.

Sekulic et al [8] this paper deals with the forces acting on the drill. There are three forces acting on the drill are force at the chisel edge, force at the cutting edge and force resulting from friction at the margin. The result shows that the force at the chisel edge has the greater influence on the thrust force.

Kyratsis et al [9] this paper performed on the effects of input parameters on drilling Al7075. The input parameters are tool diameter, cutting speed, feed rate and the output parameters are thrust force and torque. To identify the significant factor response surface methodology (RSM) is used. The result shows that the tool diameter and feed rate has the significant factor for both thrust force and torque.

Prakash et al [10] this paper performed on the evaluation of thrust force and torque in drilling of Aluminium 6063-T6 alloys. The input parameters are speed, drill diameter, feed rate. The result shows that the speed is more influence than feed rate in thrust force.

3. CONCLUSION

From literature review it is observed that many researchers had taken spindle speed, feed rate, drill diameter as input parameters and few has taken depth of cut, point angle, cutting fluid, and helix angle. The output parameters are thrust force and torque. It is found that for thrust force spindle speed and feed rate are the most significant factor.

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