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Optimization of Hole-Making Operations

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Abstract

This paper reports a tabu-search approach to minimize the total manual processing cost for hole-marking operations. on Power Press. Four issues, namely, Manual marking on angle, ideal time of machine while marking, non operating cycle time increase, and tang of production not match with mass production tang. The total processing cost consists of Ideal machining time cost, operates ideal time cost. In addition the problem under consideration is more complex since the cost associated with each operation is both sequence-dependent and position-dependent. To provide an efficient solution procedure, a tabu search approach is used. To improve the search performance two new neighborhood generation and move selection policies have been proposed and tested. The decisions on the above issues can be made simultaneously based on the output of the proposed algorithm. The results obtained from computational experiments show that the total processing cost can be significantly reduced within a reasonable time.

Keywords: Tabu Search Approach.

Introduction

Hole-making operations such as punching, drilling, account for a large portion of machining processes for many industrial parts such as fabrication and tower line. For instance, a typical hole marking could have over 10 holes at a different center distance, depths, tolerance and surface specifications, representing various location requirements. Due to the point-to-point machining feature in hole making, marking hole takes a significant amount of time. A considerable amount of the processing time is spent on marking hole position and forward the job from one punching location to another. The average cycle time taken has shown that marking hole position and job movements take on average 70% of the total time in a manufacturing process. which directly influences Man power and machining costs. To reduce the cycle time, it may be suggested that the automatic feeding mechanism is used to move the job at a given distance. This however will lead to excessive marking time. Furthermore, the center distance between two holes and number of holes not required to mark the hole. It is just give the relative center distance of hole and the mechanism will move job at its given distance. The manpower cost and machine ideal time affected by the selection of automatic feeding mechanism. Hence, the proper determination of the operations sequence and the corresponding machining speed used to perform each operation are crucial in reducing the total cost of production.

Surprisingly the above problem has not been addressed directly in literature. The studies on similar problems in punching operations are also scarce. In this direction, Walas and Askin [2] and Chauney et al. [3] proposed heuristic algorithms based on the travelling salesman problem to minimize total tool travel distance in punching operations. Using an artificial intelligence approach, Ssemakula and Rangachar [4] proposed a method to generate an operation sequence applicable to a variety of manufacturing processes. Roychoudhury and Muth [5] examined several heuristic techniques for NC punch press operation sequencing. Luong and Spedding [6] are among the few who addressed process planning in hole making operations. They developed a generic knowledge based system for process planning and cost estimation in hole making. Based on input data, the proposed system can recommend the appropriate tools, tool sequence, and machining conditions for each individual hole. The manufacturing cost is then calculated based on the recommended process plan. A similar approach was taken by Khoshnevis and Tan [7] to develop rule-base modules for hole making. Their system can be used to provide a process plan found from all possible operation sequences for a given feature.

Problem Statement

Problem Description

As mentioned earlier, this paper attempts at developing an efficient solution method to avoid the manual marking before operation starts. the best sequence of operations and associated machining speeds in hole-making operations so that the total

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processing cost is minimized. This is a live problem in Power transmission Industries. Mass production on CNC Punching machine and proto type production on manual operated Punching machine. Mass production on CNC Punching machine tong is higher than the proto type production on manual operated Punching machine. Each Hole is fist marking on job as per given dimension. Marking on job operate is baize and machine is idle and Rejection percentage is higher than CNC production.

The problem is now to select a set of operations along with the optimum cutting speed and sequence those operations in such a way that the total processing cost is minimized. The cost components considered in this paper include.

a) Idle Machine *cost*: This is the cost associate with machine. when operator is baize in marking on job machine is idle for that much time that mines it is idle machine cost.

b)Production Lost cost: Operator while marking on job the production is stop. The time required for marking the machine is idle and production stop.

c)Time consuming: Job marking and tool aliment make is very time consuming process because it is depends on operator experience. if operator is unskilled he will take a much time for aliment of job marking and punching tool and punch the hole.

Previous Method

Power press used for punching a hole on a angle.

Previous marking method for hole distance

Show the previous Marking on angle for punching a Hole

Experimental Method

Schematic illustration of Automatic feeding mechanism for feeding a angle for punching hole at given center distance. we used rack and pinion for linear and rotation movement. Staper moter is used for move a job at a given distance.and as the position of tool and center distance of hole match to each other than the punching machine will punch the hole.

Result

After loading job on fixture observation are as

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Sr.No.	Co ordinates	Displacement
1	(2 , 0)	2 mm
2	(4 , 0)	4 mm
3	(7 , 0)	7 mm
4	(2.5 , 0)	2.5 mm
5	(9 , 0)	9 mm

Thus it shows displacement is directly proportional to tim

Conclusion

Previous Result		*Present Result*	
Loading time	*30 sec.*	*Loading time*	*30 sec.*
Clamping time	*30 sec.*	*Clamping time*	*30 sec.*
Co ordinate marking time	*20 min.*	*Co ordinate marking*	*0 min.*
Punching time	*10 sec.*	*Punching time*	*10 sec.*
Unloading time	*30 sec.*	*Unloading time*	*30 sec.*
Total cycle time	*21.5 min.*	*Total time*	*1 min. 40 sec.*

1) It as optimization the cycle time.
2) Reduced rejection PPM.
3) Reduced manpower
4) Operator efficiency increases.
5) Increase productivity.

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