Innovative Journal for Opportunities and Development in Science & Technology, Volume 1, Issue 6,Feb. 2021 ISSN 2582-6026, Paper ID: – IJ2021V1I6

OPTIMIZATION OF MILLING OPERATION BY USING PARTICLE SWARM OPTIMIZATION TECHNIQUE

Sagar Bahirje[1], Dr.Vishwajeet Potdar[2],

PG Scholar[1], Department of Mechanical Engineering. A.G.Patil Institute of Technology Solapur,
Professor[2], Department of Mechanical Engineering. A.G.Patil Institute of Technology Solapur,
sagarbahirje@gmail.com
v.principal@agpit.edu.in

ABSTRACT **-**End milling is the widely used operation for metal removal in a variety of manufacturing industries including the automobile and aerospace sector where quality is an important factor in the production of slots, pockets and molds /dies. End mills are used in milling applications such as profile milling, tracer milling, face milling, and plunging. The end mills are used for light operations like cutting slots, machining accurate holes producing narrow flat surfaces and for profile milling operations. End milling is the operation of machining horizontal or vertical surfaces by using end milling. The operation is usually performed on vertical milling machine. Surface roughness is one of the most important parameters to determine the quality of a product. Surface roughness consists of the fine irregularities of the surface texture, including feed marks generated by the machining process.
Key Words: PSO, Eng Milling, Tool-Path

I. INTRODUCTION

In the past few years, manufacturing companies have been competitive in a progressively dynamic atmosphere. Among them, small and medium-sized businesses are increasing significantly, innovations are on the rise and product-life cycles have got shorter. For these reasons, corporations have been compelled to devote additional effort and resources to combat in an extremely competitive market while still generating profit. industry, it has been rumored that makers are typically facing significant sensible issues when making attempts to remodel operations aimed at implementing changes in the existing environments. A very useful gizmo that helps avoid superfluous expenses and conjointly provide a concept of the potential effectiveness of systems beforehand is simulation. According to Bennett, simulation can be outlined as “a technique or a collection of techniques whereby the development of models helps one to grasp the behavior of a system, real or hypothetical”. For this reason, simulation is widely related for exploring prospects and evaluating system behavior. It also accommodates the internal/external changes to support process improvement efficiency.
Simulation has numerous benefits. For example; simulation deters real time process interactions, avoids uncalculated implementation investments, modifies training and conduce continuous improvements, examines mathematical models of analytic solutions to provide process definitions and helps to understand the behavior of a manufacturing system. Owing to these benefits, a decent simulation if dispensed effectively will improve production. This is often a key

competitive advantage because, the design and implementation of production is turning strategically vital among corporations. Information provided by the simulation models are supported by input data. Therefore, it is vital that the variables are analyzed properly and that input data are reliable. Within the same approach, a comprehensive knowledge of statistics is critical to interpret output information properly.

II. PROBLEM DEFINITION

In an era of historically high prices for metals and energy, manufacturers are feeling the pinch. To ease the effect of increasing cost of these products, industries are taking a closer look at the ways of keeping energy and material expenses in line. Investing in computer-controlled processes can be a strategy to cut cost.

III. METHODOLOGY

There are various traditional approaches used for solving the optimization techniques for solving the machining problem. The mainly used the nontraditional optimization techniques like genetic algorithm, genetic algorithm and particle swarm optimization .These are the essential approaches used for calculating the optimal results based on the cutting speed, feed rate, unit cost and unit time. The results are determined using these approaches with help of the software package like MasterCAM program.

FLOW CHART OF PSO

The general flow chart of PSO can be described as follows:
Step. 1: Generation of initial condition of each agent. Initial searching points (si0) and velocities (vi0) of each agent are usually generated randomly within the allowable range.
Step. 2: Evaluation of searching point of each agent. The objective function value is calculated for each agent. If the value is better than the current pbest of the agent, the pbest value is replaced by the current value.
Step. 3: Modification of each searching point.
Step. 4: Checking the exit condition. Otherwise, go to step 2.

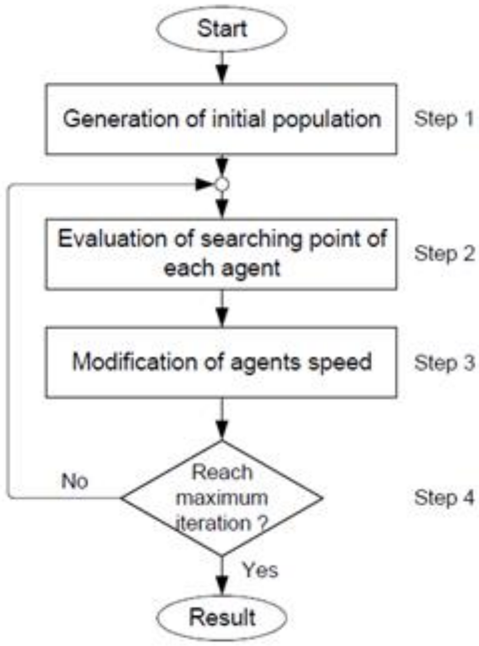

Figure 1 shows the general flow chart of PSO strateg

SPEED LIMITS

There are various speed limits with the respect to the various operations like
Face milling: 60-120 m/min
Corner milling: 40-70 m/min
Pocket milling: 40-70 m/min
Slot milling 1: 30-50m/min
Slot milling 2:30-50 m/min

3D MODEL IN MASTER CAM

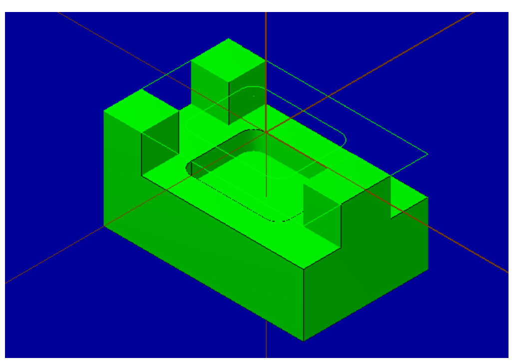

Fig. 2 Model imported in Master CAM Software

MANUFACTURING PHOTO

Fig.3 Actual manufacturing photo 1

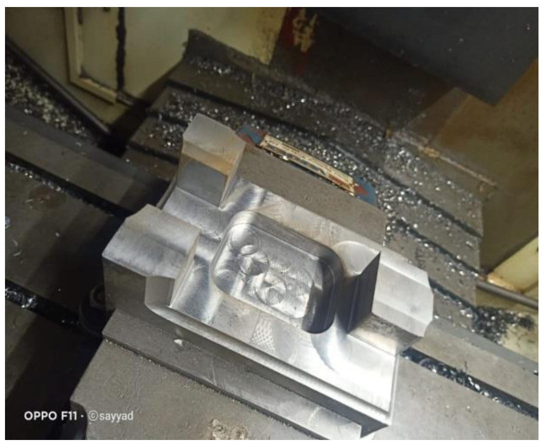

Fig.4 Actual manufacturing photo 2

IV. RESULTS

Table 1 Shows a results by simple master CAM programmed

Sr.no.	Process	Tool	Tool Speed	Feed Rate	Dept of cut
1	Facing	Ø54	900	0.4	0.3
2	contour	Ø 25	1800	0.4	0.22
3	Pocket	Ø 12	4000	0.3	0.2

Table1. MasterCAM output for manufacturing

Total Machining Time = 5 hr 30 min

Table 2. Shows a result by PSO optimization

Sr.no.	Process	Tool	Tool Speed	Feed Rate	Dept of cut
1	Facing	Ø54	920	0.42	0.3
2	contour	Ø 25	1800	0.45	0.22
3	Pocket	Ø 12	4000	0.3	0.2

Table 2. Output result by PSO optimization

Total Machining Time = 5 hr 10 min

V. CONCLUSION

The simulation process of finding minimum machining time in CNC milling machine is carried out for one of the model found in the literature survey and got reasonable results.
Initially 3D model is generated which is undergone by three milling operations (facing, cornering, pocketing and two) and required machining parameters (speed, feed and depth of cut) is given.
While giving the tool path we found that one milling operation can be minimized i.e., corner milling, since its corner radius is 5mm and tool used for pocketing is 10mm it can be performed by pocketing operation itself. Hence machining time is minimized.
The results obtained are compared with the other method and genetic algorithm yields an optimal result.

REFERENCES

[1] **Kennedy, J., & Eberhart, R. (1995)**,"Particle swarm optimization"; Proceedings of the IEEE International Conference on Neural Networks (ICNN'95), Perth, Australia

[2] **MarkoReibenschuhF.Cus and Zuperl,**"Particle swarm intelligence based optimization of high speed End milling;."Vol3 pp383-393

[3] **Haron and Shariff (2010)** "Application of GA to optimize cutting condition for minimizing surface roughness in end milling machining process",Vol37,pp 4650-4659

[4] **H.ganesan&g.mohankumar, k.ganesan, k.rameshkumar,** "optimization of machining parameters in turning process using genetic algorithm and particle swarm optimization with experimental verification";ISSN : 0975-5462 Vol. 3 No. 2 Feb 2011

[5] **Meenu&anujkumarsehgal,** "surface roughness optimization by response Surface methodology and particle swarm optimization";ISSN : 0975-5462 Vol. 5 No.07 July 2013

[6] **Vikas Pare, GeetaAgnihotri& C.M. krishna I**, "Optimization of Cutting Conditions in End Milling Process with the Approach of Particle Swarm Optimization"; ISSN no. 2231 –6477, volume-1, issue-2, 2011

[7] **Baskar, N., Asokan, P., Saravanan, R. and Prabhaharan, G., (2004),** “Optimization of machining parameters for milling operations using Non-conventional methods”; International Journal of Advanced Manufacturing Technology., Vol. 25, pp. 1078–1088

[8] **Alauddin, M., El Baradie, M. A., and Hashmi, M. S. J., (1995),**“Computer-aided analysis of a surface-roughness model for end milling”; Journal of Material Process. Technology Vol. 55, pp. 123–127.