International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 3, May-Jun-2019, ISSN (Online): 2395-566X

Improvement Productivity in Balancing Assembly Line by Using Pso Algorithm

Deepak Solanki **Mr. Kamlesh Gurjar**
Dept. of Industrial Engg.
Shri Aurobindo Institute of Technology
Indore, MP, India

***Abstract*- Assembly line balancing plays a crucial role in modern manufacturing companies in terms of the growth in productivity and reduction in costs. The problem of assigning tasks to consecutive stations in such a way that one or more objectives are optimized with subject to the required tasks, processing times and some specific constraints, is called Assembly Line Balancing (ALB) The present study also describes KANBAN withdrawal Methodology for production time period of 0.6 minutes only for single stage Assembly line. The study also determines the maximum number of iterations in PSO, which finds the final economical costing over other parameters, variable demands and number of workers. The Simulation Tool MATLAB (2015a) has been used to design Simulink model of balancing parallel Assembly line and for Graphical Analysis of each product.**

***Keywords*- Assembly line balancing, Two-sided assembly lines, Teaching-learning based optimization, Group assignment procedure, Optimization Techniques**

I. INTRODUCTION

Nowadays, the majority of production processes in our country and each one over the world are carried through assembly operations. Therefore, assembly lines kind the premise of the manufacturing systems where production is performed in AN extremely flow-line production system; it's called as a "mass production". In these lines, raw materials or semi-finished product enter from one purpose which they pass form of operations, then they leave from manufacturing technique as finished product. First, in 1913, man of affairs started out with the thought of production associate degreed he designed AN line to manufacture the vehicles. Since then, line (AL) plan has been pervaded, as a result of its wide tested its effectiveness to produce qualified, cheap standardized similar product.

A classic line consists of serial stages, throughout that work pieces (jobs) are flowed down the road and transferred from one electronic computer to the alternative through men or material handling instrumentality. At each stage, definite assembly operations are completed repeatedly thus on get finished product. The tasks are assigned to workstations considering some restrictions in conjunction with precedence constraints form of workstations, cycle time and incompatibility relations between tasks. the matter of assignment jobs to consecutive workstations that one or further goals are optimized supported the required tasks, method times and many specific c constraints are named the assembly line feat downside (ALBP).The process of feat could also be a vital task in coming up with extraordinarily economical and worth effective assembly lines. The establishment or re-arrangement of a line thrusts of kind of} an upscale investment thus effective rules of lines ar essential at the beginning of technique. Lines ought to be balanced at intervals the design stage; otherwise unbalanced lines cause inability in production, increased worth, and a lot of casualties like waste of labour or instrumentality, Kucukkoc et al.[1]. A product, according to Askin et al.[2] is any item that is designed, manufactured and delivered with the intention of making a profit for the producer by enhancing the quality of life of the customer.

Most products are made up of various parts, where a part can be described as a single unit of a product that are brought together with others to form the finished product. Assembly, therefore, can be explained as the operation of bringing parts together, either manually by operators or automatically by robots, to form a finished product. Fixing of more complex parts that have more than one component before being assembled to the work-piece as a single unit is called a sub-assembly.

A work-piece is an unfinished product whose assembly is in progress. In order to establish a comprehensive understanding of the dynamics of assembly, it is essential to be familiar with the stages and various elements involved in the assembly process. Figure 1.1 provides a brief overview of a typical assembly process by highlighting the major constituents of an assembly line.

© 2019 IJSRET

International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 3, May-Jun-2019, ISSN (Online): 2395-566X

II. ASSEMBLY LINE

An assembly line (AL) is a production process which is composed of different operations. Work pieces are successively combined on a product at each station to manufacture a final product. ALs are the mostly used technique in mass production, as they enable the assembly of complicated products by workers with restricted training and devoted robots and/or machines. Assembly lines consist of workstations arranged by a conveyor belt or a similar material handling system. The parts are flowed towards end of the line and transferred among the workstations, Gocken, et al.[3]. At every station, specific operations are performed continually in connection with cycle time. When tasks are completed at each station, finished product is obtained.

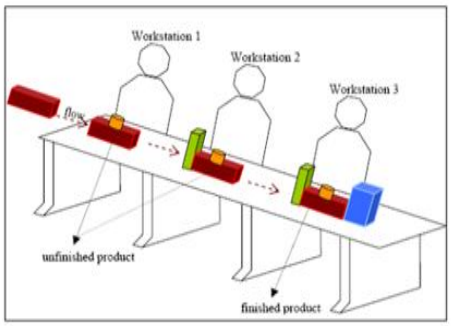

Fig. 1 A Concept of assembly line (Ozmehmet T., 2007) [4]

Assembly lines square measure flow-oriented production systems wherever the units of production playing the operations square measure aligned during a serial manner, stated as stations. staff and/or robots perform sure operations on the merchandise at the stations so as to take advantage of a high specialization of labour and therefore the associated learning effects,

Manavizadeh et al. [5]. the littlest individual and inseparable operations square measure referred to as tasks. the mandatory time for a task to be performed is named the task time or the method ingtime. each product follows the stations on the production line till the raw materials change into a final product. The operations appointed to stations square measure dole out on the merchandise at every station among a such as time. This time, that is adequate to the utmost of sums of process times of the tasks all told stations, is named the cycle time. Production rate of the production line, that is that the quantity of ultimate product created during a amount of your time, is directly determined by the cycle time. production line equalization (ALB) drawback is associate degree assignment drawback going to assign the tasks to the stations so as to reduce the cycle time, i.e. maximize the assembly rate, or minimize the road length, i.e. the force needed.

III. PRAPOSED METHOD ASSEMBLY BALANCE LINE

Particle swarm optimization (PSO) is a computational method that optimizes a problem by iteratively trying to improve a candidate solution with regard to a given measure of quality. It solves a problem by having a population of candidate solutions, here dubbed particles, and moving these particles around in the search-space according to simple mathematical formulae over the particle's position and velocity. Each particle's movement is influenced by its local best known position, but is also guided toward the best known positions in the search-space, which are updated as better positions are found by other particles. This is expected to move the swarm toward the best solutions. PSO is originally attributed to Kennedy, Eberhart and Shi and was 1st supposed for simulating social behavior, [3] as a artificial illustration of the movement of organisms during a bird flock or fish faculty. The rule was simplified and it had been discovered to be acting optimisation. The book by Kennedy and Beernaert describes several philosophical aspects of PSO and swarm intelligence. an intensive survey of PSO applications is formed by Poli Recently, a complete review on theoretical and experimental works on PSO has been revealed by Bonyadi and Michalewicz.

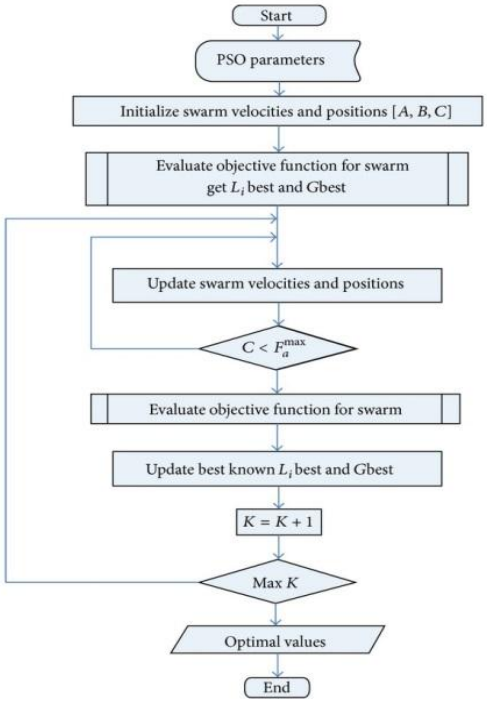

Fig. 2 Flow Chart of PSO Algorithm.

PSO is a met heuristic as it makes few or no assumptions about the problem being optimized and can search very

© 2019 IJSRET

large spaces of candidate solutions. However, met heuristics such as PSO do not guarantee an optimal solution is ever found. Also, PSO does not use the gradient of the problem being optimized, which means PSO does not require that the optimization problem be differentiable as is required by classic optimization methods such as gradient descent and quasi-Newton methods.

IV. RESULTS

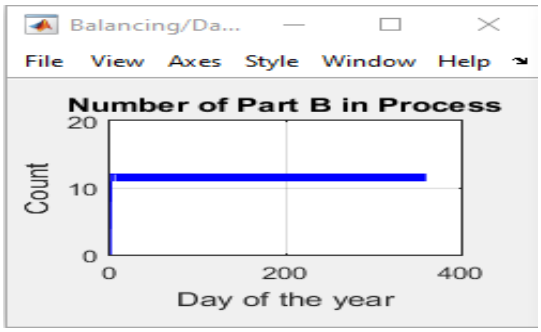

Fig. 4 product B in process.

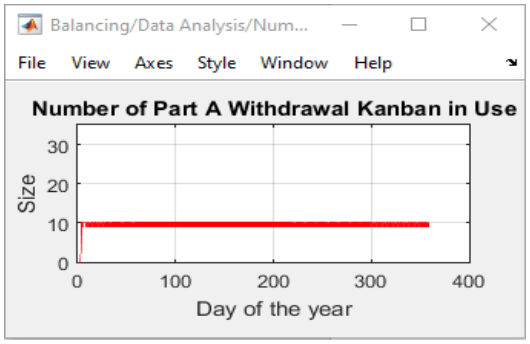

Fig.5 Product A withdrawal Kanban.

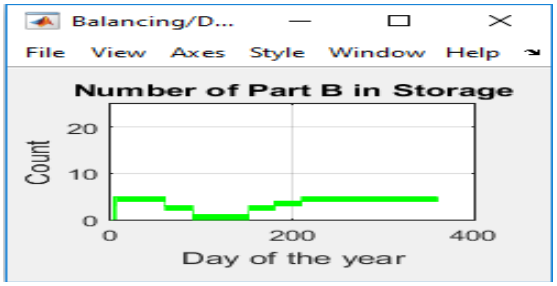

Fig.6 Two parallel assembly line controlling.

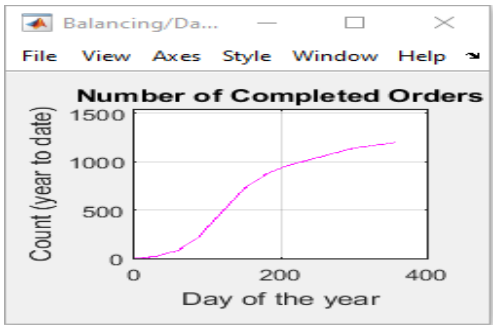

Fig.7 Two parallel assembly line cont rolling.

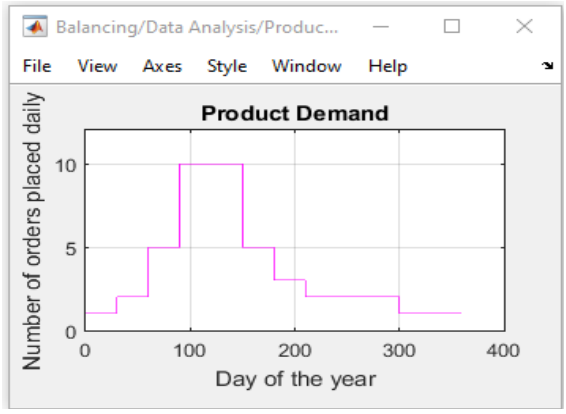

Fig.8 Two parallel assembly line controlling completed orders.

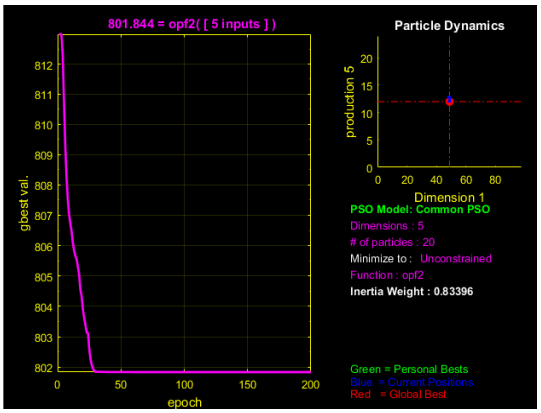

Fig.9 Optimization graphs.

V. CONCLUSION

The objective of this thesis is to improve the productivity and line assembly efficiency approximately 92%. The three step methodology incorporating Lean principles is applied to the case study problem and two different assembly configurations are developed and compared, namely Single Stage Parallel Line and Five Stage Serial Line. Based on the simulation performance results, the Single Stage Parallel Line is suggested to be

© 2019 IJSRET

implemented. The original assembly line has a target output of 500 boxes/operator/hour, whereas the actual measured output came up to 29.8 boxes/operator/hour with worker size minimum 130 and 0.6 productivity time period. The improved assembly line efficiency gives an output of 500 boxes/operator/hour, which is about a 92% increase in operator productivity efficiency. From the original method, when a situation for maximum 10 count and storage time 0.2 for each product, transportation time 0.7. Also, with this Single Stage Parallel Line with the help of PSO, the floor space usage is reduced by half compared to original method. This method also determines the material handling requirements as well as the input and output buffer sizes with this new assembly line. When having an assembly line with multiple stations, the impact of having station imbalances on the individual operator performance is also recognized.

REFERENCE

[1] Kucukkoc, I., Karaoglan, A.D., and Yaman, R., Using response surface design to determine the optimal parameters of genetic algorithm and a case study. International Journal of Production Research, 2013. 51(17):p. 5039-5054.

[2] Askin, R.G. and Zhou, M., A parallel station heuristic for the mixed model production line balancing problem. International Journal of Production Research, 1997. 35(11): p. 3095-3105.

[3] Gokcen, H., Agpak, K., and Benzer, R., Balancing of parallel assembly lines. International Journal of Production Economics, 2006. 103(2): p. 600-609

[4] Ozmehmet T., M., Ferrari, E., Persona, A., and Sgarbossa, F., Design configuration for mixed-model assembly system in case of low product demand. International Journal of Advanced Manufacturing Technology, 2007. 34(1-2): p. 188-200.

[5] Manavizadeh, N., Hosseini, N.S., Rabbani, M., and Jolai, F., A Simulated Annealing algorithm for a mixed model assembly U-line balancing type-I problem considering human efficiency and Just-In-Time approach. Computers & Industrial Engineering, 2013. 64(2): p.669-685.

[6] Chutima, P. and Chimklai, P., Multi-objective two-sided mixed-model assembly line balancing using particle swarm optimisation with negative knowledge. Computers & Industrial Engineering, 2012. 62(1): p. 39-55.

[7] Kara, Y., Ozguven, C., Yalcin, N., and Atasagun, Y., Balancing straight and U-shaped assembly lines with resource dependent task times. International Journal of Production Research, 2011. 49(21): p. 6387-6405.

© 2019 IJSRET