

# Improvement Productivity in Balancing Assembly Line by using Pso Algorithm

**M.Tech.Scholar Nikhil Porwal**  
Dept of Mechanical Engineering  
VITM Indor ,India

**Prof. Prakash Girwal**  
Dept of Mechanical Engineering  
VITM Indor ,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). This research work focuses on optimization of product cost, Assembling time and Production Completed order with the help of PSO 30 days and 26 days data sets of a production industry. The present study also describes KANBAN withdrawal Methodology for production time period of 0.6 minutes only for single stage Assembly line.

**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 are 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 products enter from one purpose which they pass through operations, then they leave from manufacturing technique as finished product. First, in 1913, Henry Ford started out with the thought of production and designed the assembly line to manufacture the vehicles. Since then, the assembly line (AL) plan has been pervaded, as a result of its wide tested effectiveness to produce qualified, cheap standardized similar products.

A classic line consists of serial stages, throughout that workpieces (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 to 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 constraints are named the assembly line feature downside (ALBP).

The process of feature 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 are 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 labor 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.

## 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.

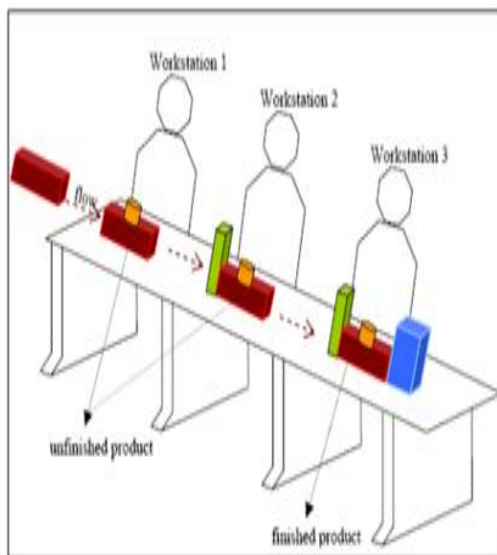


Fig.1. A Concept of assembly line. (Ozmehmet T., 2007)

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 behaviour, [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 Eberhart 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.

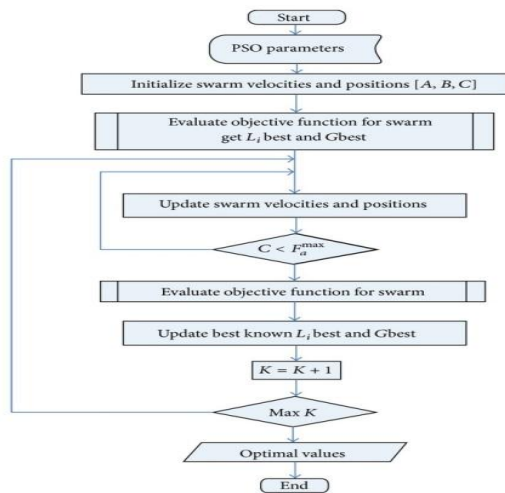


Fig.2 Flow Chart of PSO Algorithm

PSO is a metaheuristic as it makes few or no assumptions about the problem being optimized and can search very large spaces of candidate solutions. However, metaheuristics 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

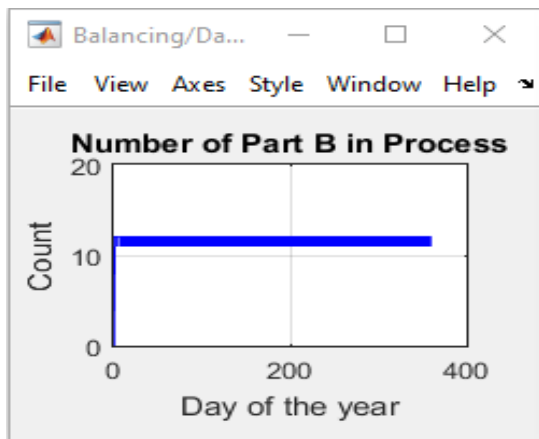


Fig. 3 Product A withdrawal Kanban

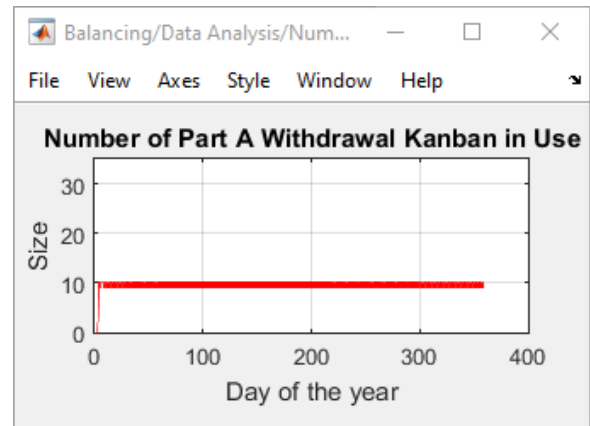


Fig.4 Two parallel assembly line controlling.

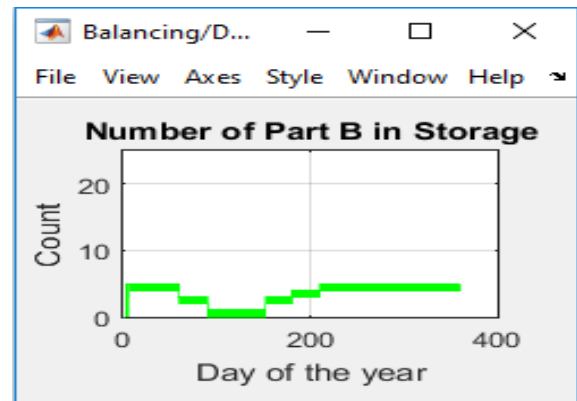


Fig.5 product B n process.

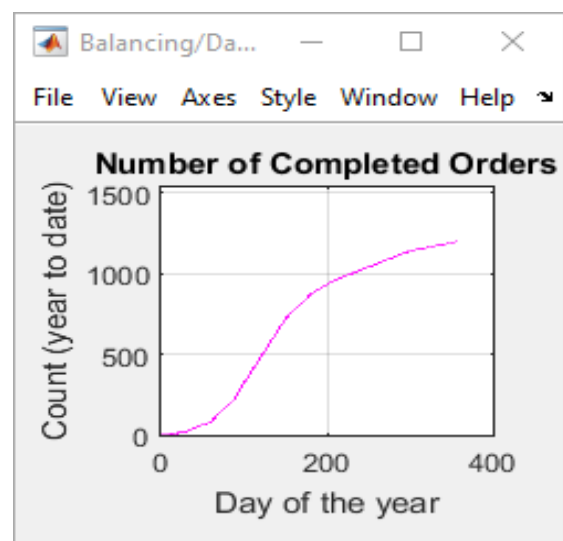


Fig.6. Two parallel assembly line controlling.

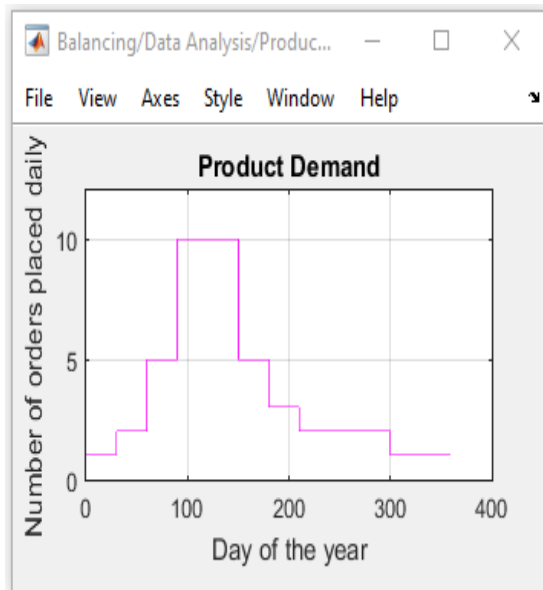


Fig. 7 Two parallel assembly line controlling.

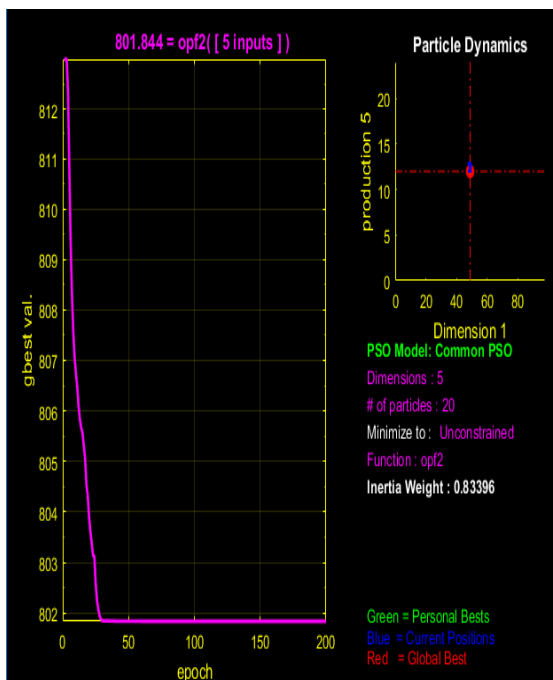


Fig.8 Optimization graphs.

## V. CONCLUSION

Simulation and optimization in manufacturing process are the part of automating the factory floor. Simulation of the production line in this thesis work is done with

MATLAB, for data acquisition, such as, cycle time, and utilization of each workstation. MATLAB makes the simulation and programming of the line faster and easier. Optimizing the data and studying them, leads to implementation of balanced assembly line model. In this thesis balanced assembly line model has been represented, with improvements in completion times for the products. The model with two different products A and B for one workstation has the best results, and we get constant result of number of completed orders after applying this optimization technique thus reducing the number of dropped orders. Variations in the number of completed orders in assembly line is the reason for choosing the model for optimization. Implementing an optimization system on simulated manufacturing line is the intention of engineers, since it can decrease product delivery time and thus increases line efficiency. In this work PSO algorithms are implemented on the non-linear model for optimizing the productivity and economical costing products. PSO algorithm has been chosen for this work, because this algorithm is a method for searching the best solution among the solutions provided by the line.

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