# A Survey on Published Papers on Optimization in the Assembly Line Balancing Problems in a Heavy Engineering Industry

**DILIP KUMAR ADHWARJEE**
Dr. B.C.Roy Engineering College
Durgapur
West Bengal University Of Technology

**M.C.MAJUMDER**
National Institute Of Technology
Durgapur
Deemed University, India.

**NILOTPAL BANERJEE**
National Institute Of Technology
Durgapur
Deemed University, India.

*Abstract:* **This paper gives a survey report on different optimization techniques used by different authors on assembly line balancing problems. The author gives a new technique which is different from them on minimization of number of work stations of a ALBP-1.**

*Keywords:* **Tabu Search, Genetic Algorithms, Ant colony optimization, Particle Swarm Optimization, Discrete Particle Swarm Optimization.**

## I. PROCEDURE

***1.1 Title:*** Simple assembly line balancing – Heuristic approaches

Authors: Armin Scholl, Germany, and Stefan vob, Germany

Journal: Journal of Heuristic, 2, 217-244(1996)

Discussion : Type 1 simple assembly line balancing problem (SALBP-1) consists of assigning tasks to work stations such that the number of work stations is minimized for a given production rate. Precedence constraints between the tasks have to be considered. SALBP-1 is present when a new assembly line system has to be installed and the external demand can be well estimated.

Type 2 of simple assembly line balancing problem (SALBP-2) is to maximize the production rate, or equivalently, to minimize the sum of idle times for a given number of work stations. Here also precedence constraints between the tasks have to be considered. SALBP-2 leads to maximization of the production rate of an existing assembly line which is important when changes in the production process or the demand structure take place

***1.2 Title:*** A discrete particle swarm optimization algorithm for assembly line balancing problem of type -1

Authors: Dou Jianping, Su Chun, Li Jun

Journal: Third international conference on measuring technology and mechatronics automation (2011), IEEE.

Discussion: Discrete particle swarm optimization technique (DPSO) is applied to minimize the number of work stations when the cycle time is given. PSO is developed by Kennedy and Eberhart

They are inspired by the social behaviour of a flock of migrating birds trying to reach an unknown destination. In PSO, each solution is a bird in the flock and is referred to as a particle. A particle in the population evolves their social behaviour and accordingly their movement towards a destination. However PSO cannot be directly applied to SALBP-1 because it is applied to a continuous optimization problem. DPSO is applied to SALBP-1.

***1.3 Title:*** Solving assembly line balancing problem using Genetic Algorithm with Heuristic-Treated Initial Population.

Authors: Kuan Eng Chong, Mohamed K. Omar, and Nooh Abu Bakar

Journal : Conference proceedings of World Congress on Engineering ,2008 Vol II, WCE 2008, July2-4, London, U.K.

Discussion: SALBP-F determines whether or not a feasible assembly configuration exists for a given combination of Cycle time and number of work stations.

SALBP-E attempts to maximize the line efficiency by minimizing the number of work stations and cycle time simultaneously. The authors apply a computer method of sequencing operations for assembly lines. They use software called COMSOAL.

***1.4 Title:*** Dynamic Segregative Genetic Algorithm for Assembly line balancing.

Authors: Octav Brudaru, Cristian Rotaru

Journal: 12$^{TH}$ International symposium on symbolic and Numeric Algorithms for Scientific Computing.

Discussion: The Authors apply Segregative Genetic Algorithms to “I/ U” shaped assembly line.

***1.5 Title:*** Research on Optimization for balance of BSP model assembly line based on Flexsim.

Authors: Ge Anhua , Zhang Yuqiao

Journal: 2010 3$^{rd}$ International conference on Information Management, Innovation Management and Industrial Engineering, IEEE

  

Discussion: The paper is focussed on assembly line for BSP models of a company , balance for which is to be improved through Industrial engineering methods. Balance of the assembly line is studied by system simulation technology. By using simulation- Balance Simulation Method, comparative analysis on the important indicator and station utilization before and after the balance is carried out, so as to achieve balanced processes load, improve ALB rate, reduce waste and production costs.

***1.6 Title:*** Improving the piston assembly by Machine Vision Recognition Technology (MVRT)

Authors: Xiao-Feng Yue, Yan-Wen Ren, Song Lei, Wang Wei

Journal: 2010 International Conference on Computer, Mechatronics, Control and Electronics Engg, IEEE

Discussion: In a large car factory, five different types of engines are cross-assembled in a high-speed gasoline engine assembly line at the same time. Different quality problems occur during installing the cylinder in to the piston, such as missed assembling, reversed assembling and mixed assembling, because of workers' operation errors. To improve the quality of piston assembling quality and reduce labour intensity, the factory puts forward a technological transformation proposition," Using the MVRT to detect the quality of piston assembly"

***1.7 Title:*** A survey on problems and methods in generalised assembly line balancing

Authors: Christian Becker, Armin Scholl

Journal: European Journal of operational Research 168(2006) 694-715 Elsevier.

Discussion: The authors in their paper discuss in details of the following

a) Assembly lines for single and multiple products
b) Cost and Profit oriented objectives
c) Parallel stations
d) U-Shaped assembly line

***1.8 Title:*** Two-sided Assembly line balancing to maximize work relatedness and slackness.

Authors: Tae OK Lee, Yeongho Kim, Yeo Keun Kim

Journal: Journal of Computers & Industrial Engineering 40 (2001) 273-292, Pergamon, Elsevier.

Discussion: The authors discuss left and right sides of assembly lines. They maximize work relatedness and minimize the slackness.

***1.9 Title:*** ALBP –which model to use when?

Authors: Nils Boysen, Matte Fliedner, Armin Scholl

Journal: International journal of Production Economics- Science Direct, Elsevier 2007

Discussion: The authors discuss the following

a) Basic problem of ALB
b) A classification of ALBP extensions
c) ALB in dependency of the number of models
d) ALB in dependency of line control
e) ALB with regard to its frequency
f) ALB and the level of automation
g) Line of business specific ALB

## II. CONCLUSION

The Author has studied almost seventy five journals and conferences .They used the following optimization techniques

a) Genetic Algorithms
b) Tabu Search
c) Simulated Annealing
d) Ant Colony Optimization
e) Particle Swarm Optimization
f) Discrete Particle Swarm Optimization

In my research paper I have used Heuristic based with C Programming for SALBP-1. The readers may refer the following journal.

TITLE: The assembly line balancing problem and its solution using " C" language

International journal of Engineering Science & Technology (IJEST): ISSN 0975-5462, Vol 4 no 08 August 2012 page no 3709-3711, Author-DKA, NB, MCM, MN

## III. SCOPE FOR FURTHER STUDY

The readers may do research on ALBP by using other type of computer language like FORTRAN etc to solve NP hard problem

## REFERENCES

[1] Scholl, A; Becker, C; 2006. State-of-the-art exact and heuristic solution procedures for simple assembly line balancing. European Journal of Operations Research

[2] Wilson, J.M; 1986. Formulation of a problem involving assembly lines with multiple manning of work stations.International Journal of Production Research 24, 59-63

[3] Hou Dongliang, 2008. Application of work study in the balance of bilateral Assembly Line(J) . Industrial Engineering and Management,2008(3):121-123

[4] Liu Jinhao, Hou Dongliang. A brief analysis on method of solving the balance issue of

  

Assembly Line. Forecast Engineering, 2006,22(4):21-24

[5] Baybars, I. (1986). A survey of exact algorithms for the simple assembly line balancing problem, Management Science 32, 909-932.

[6] Dar-EI, E.M(1975). Solving large single model assembly line balancing problems-a comparative study. AIIE Trans. 7, 302-310

[7] Hoffmann, T. R... Assembly line balancing with a Precedence Matrix, Management Science 9, 551-562

[8] Amen, M., 2000b. Heuristic methods for cost-oriented assembly line balancing: a survey. International Journal of Production Economics 68, 1-14

  