

**“STUDY OF TWO SIDED ASSEMBLY LINE BALANCING USING
GENETIC ALGORITHM”**

A

**THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENT FOR
THE AWARD OF THE DEGREE OF
MASTER OF TECHNOLOGY**

IN

PRODUCTION ENGINEERING

BY

GORAD SAGAR RAMCHANDRA

(ROLL NO- 2K12/PRD/06)

GUIDED BY

DR. RAJIV CHAUDHARY

DR. RAMESH CHANDRA SINGH



**Department of Mechanical, Production, Industrial and Automobile
Engineering**

Delhi Technological University

July 2014

**“STUDY OF TWO SIDED ASSEMBLY LINE BALANCING USING
GENETIC ALGORITHM”**

A

**THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENT FOR
THE AWARD OF THE DEGREE OF
MASTER OF TECHNOLOGY**

IN

PRODUCTION ENGINEERING

BY

GORAD SAGAR RAMCHANDRA

(ROLL NO- 2K12/PRD/06)

GUIDED BY

DR. RAJIV CHAUDHARY

DR. RAMESH CHANDRA SINGH



**Department of Mechanical, Production, Industrial and Automobile
Engineering**

Delhi Technological University

July 2014

DECLARATION

I hereby declare that the thesis entitled “**STUDY OF TWO SIDED ASSEMBLY LINE BALANCING USING GENETIC ALGORITHM**” which is being submitted to the Delhi Technological University, in partial fulfillment of the requirement for the award of degree of Master of Technology in Production Engineering is an authentic work carried out by me.

Gorad Sagar Ramchandra

(2K12/PRD/06)



CERTIFICATE

This is to certify that the report entitled, **“Study of two sided assembly line balancing using genetic algorithm”** submitted by **Mr. Gorad Sagar Ramchandra** in partial fulfillment of the requirements for the award of **Master of Technology Degree in Production Engineering** at **Delhi Technological University, Delhi** is an authentic work carried out by him under our supervision and guidance.

To the best of our knowledge the matter embodied in this report has not submitted to any other university / institute for award of any degree.

Dr. Rajiv Chaudhary

Dr. Ramesh Chandra Singh

Date:

Date:

ACKNOWLEDGEMENT

While bringing out this thesis to its final form, I came across a number of people whose contributions in various ways helped me in field of research and they deserve special thanks. It is a pleasure to convey my gratitude to all of them.

First and foremost, I would like to express my deep sense of gratitude and indebtedness to my supervisors Dr. Rajiv Chaudhary and Dr. Ramesh Chndra Singh for their invaluable encouragement, suggestions and support from an early stage of this research and providing me extraordinary experiences throughout the work. I also thanks Dr. Naveen Kumar (Head of Department) for his support in my project research. Above all, their priceless and meticulous supervision at each and every phase of work inspired me in innumerable ways.

I specially acknowledge them for their advice, supervision, and the vital contribution as and when required during this research. Their involvement with originality has triggered and nourished my intellectual maturity that will help me for a long time to come.

Gorad Sagar Ramchandra

INDEX

Declaration.....	i
Certificate.....	ii
Acknowledgement.....	iii
Index.....	iv
List of Figures.....	vi
List of Tables.....	vii
Abstract.....	viii
Chapter 1. Introduction.....	1-11
1.1. Assembly line balancing.....	2
1.2. Types of assembly lines.....	3
1.3. Two sided Assembly line.....	5
1.4. Genetic Algorithm.....	8
Chapter 2. Literature review.....	12-18
Chapter 3. Experimentation.....	19-36
3.1. Methodology.....	20
3.2. Problem with 9 tasks	23
3.3. Problem with 16 tasks	30

Chapter 4. Results	37-39
Chapter 5. Conclusions	40-42
Chapter 6. Future scopes	43-45
References.....	46-50

LIST OF FIGURES

Figure No.	Name of Figure	Page No.
Figure 1	Two Sided Assembly	5
Figure2	Precedence diagram for two sided assembly	6
Figure3	Presentation of Two Sided Assembly Line	7
Figure4	General scheme of GA	10
Figure 5	Problem with positional constraints	14
Figure 6	Precedence preservative crossover	16
Figure 7	Task based representation	16
Figure 8	Problem with 9 tasks	22,23,25,27
Figure 9	Problem with 16 tasks	30,32,34
Figure10	Comparison Chart	39

LIST OF TABLES

Sr.No.	Name of Table	Page No.
1	Calculation of Similarity measure	17,21
2	Initial population for problem with 9 tasks, forward direction	23
3	Calculations for problem with 9 tasks, forward direction	24
4	Initial population for problem with 9 tasks, backward direction	25
5	Calculations for problem with 9 tasks, backward direction	26
6	Initial population for problem with 9 tasks, random direction	28
7	Calculations for problem with 9 tasks, random direction	28
8	Initial population for problem with 16 tasks, forward direction	30
9	Calculations for problem with 16 tasks, forward direction	31
10	Initial population for problem with 16 tasks, backward direction	32
11	Calculations for problem with 16 tasks, backward direction	33
12	Initial population for problem with 16 tasks, random direction	35
13	Calculations for problem with 16 tasks, random direction	35
14	Similarity measures	38

ABSTRACT

Two-sided assembly lines are common industrial practice in the assembly of large-sized products. It provides shorter line length, reduced throughput time, lower cost of tools and fixtures, and less material handling. In a two-sided assembly line, the products wait during the cycle time at each mated-station where there are two operators working at the opposite sides of the line simultaneously performing the different tasks on the same individual product.

Genetic algorithms have received an increasing attention from the researchers since it provides an alternative to traditional optimization techniques by using directed random searches to locate optimum solutions in complex landscapes.

In this thesis various features of genetic algorithms proposed for balancing of two sided assembly lines are studied and discussed.

Initial population is one of the key feature in the genetic algorithm. Performance of algorithm and early convergence is dependent on the initial population. The diverse initial population helps to check all areas of solution space and prevents the trapping in local optimum. The effect of direction of generation over diversity in initial population is studied. A new method is developed to generate initial population to increase the diversity. The proposed method is applied on small sized problems to measure the performance.

It is evident from the results that though diversity in population largely depends upon the precedence relations of the tasks in problem, it can vary to a great extent with the use of random direction of generation.