Job Scheduling Using Hybrid Genetic and Cuckoo Search Algorithm

A Dissertation submitted

By satyendra singh

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Mr. Sudhanshu Prakash Tiwari

Assistant professor

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DISSERTATION TOPIC APPROVAL PERFORMA

Name of the Student: _Satyendra_   Registration No. _11310948_

Batch: _2013-15_   Roll No. _B70_

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Details of Supervisor: Designation: _Asst. professor_

Name _Shudhanshu prakash_   Qualification: _M.tech_

uid _15813_   Research Experience: _3 years_

SPECIALIZATION AREA: _Soft computing_   (pick from list of provided specialization areas by DAA)

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ABSTRACT

Job scheduling is a type of combinatorial optimization problem. In this paper, we have proposed a hybrid algorithm which combines the merits of genetic and Cuckoo Search. The major problem in the genetic algorithm is that it becomes easily trapped in local minima. Cuckoo search can perform the local search more efficiently and there is only a single parameter apart from the population size. It minimizes the makespan. Job scheduling is NP hard problem for which we cannot find an exact solution. In this paper we have applied our proposed hybrid genetic algorithm to reduce the completion time. This hybrid algorithm finds an optimal schedule of machines for jobs in such a fairly manner that it minimizes the makespan time and all jobs get desired machines.

ACKNOWLDGEMENT

I am deeply grateful to my mentor, Mr. Sudhanshu Prakash Tiwari, for his guidance, patience and support. I consider myself very fortunate for being able to work with a very sincere, considerate and encouraging professor like him. Without his offering to accomplish this research, I would not be able to do my dissertation-I work at Lovely professional University. I'm much obliged to my friends. Their enlightening suggestions and encouragements made me feel I was not isolated in my research.

CERTIFICATE

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This is to certify that **satyendra singh** has completed M.TECH dissertation title "**Job scheduling using hybrid genetic and cuckoo search algorithm"** under my guidance and Supervision. To the best of my knowledge, the present work is his original investigation and study. No part of dissertation has ever been submitted for the any degree and diploma. This dissertation is fit for the submission and partial fulfilment of the condition and for the award of M.TECH computer science and engineering

.

Signature of the advisor

Name- Sudhanshu Prakash Tiwari
UID-15813

DECLERATION

I hereby declare that the dissertation entitled**, Job scheduling using hybrid genetic and cuckoo search algorithm** submitted for the M.Tech Degree is entirely my original work and all ideas and references have been duly acknowledged. It does not contain any work for the award of any other degree or diploma.

Investigator
Reg. No. 11310948

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1.1 OPTIMIZATION ALGORITHM:

Optimization algorithms [8] are the algorithm which is being used to solve NP-type of difficulty. Basically there are two types of optimization algorithm evolutionary and metaheuristic algorithm. Evolutionary algorithm are those algorithm which are based on natural process examples of evolutionary algorithm are Genetic algorithm and Cuckoo search algorithm. Metaheuristic algorithms are those algorithms that are based on past result or history.

Optimization algorithm is an algorithm in which we minimize the cost and effort required in the problem. Here effort shows no. of iteration and cost shows time required to execute the algorithm. The representation of Optimization problem is as follows:

Input: $f : A \rightarrow R$**,** where f is a function and R is set of real numbers.

Output: We try to find out an element x_1 in A such that

$f(x_1) \leq f(x)$ for all x in A (represents minimization)

$f(x_1) \geq f(x)$ for all x in A (represents maximization)

A combinatorial optimization problem is that problem in which an optimal ordering and selection of options is desired.

1.2 JOB SCHEDULING:

Job scheduling [3,6,7,8] is a NP-hard tricky.NP –hard difficulty is a set of all decision problem for which no result occur in polynomial time but answer can be verified in polynomial time. Job scheduling [5] is the method of allocating resources to the several jobs. Importance has been on exploring machine arrangement difficulties where jobs characterize activities and machines denote resources. Each machine can practice at most one task at a time.

 Approximately of the norms for job scheduling are as charts

- Jobs are restricted.
- All jobs hold a set of operations that needs to be performed.
- Machines should be restricted.
- Each machine is capable of controlling only one procedure at a time.

 Some restrictions for job scheduling stand as follows:

- Single machine can call a job single time.

- Processes of all tasks should be free to one other.

- Processes that can be removed forcefully are not allowed.

- A single machine is capable of solving a single process at a time.

- Machines should working properly during execution of jobs.

1.3 GENETIC ALGORITHM:

The Genetic Algorithm [7,10,12] was firstly castoff by Holland (1975).It's procedure is based on the explanations of evolutionary procedure observed in environment. As opposed to many other optimization methods, Genetic algorithm starts with multiple solutions instead of a single solution. Genetic algorithm provides a value to each single in the inhabitants based on objective function of problem. Selection step choose the fittest single from the pool of population. Boundary step is used to create new childes from selected parents. Mutation operator is used to retain genomic variety. Genetic algorithm is an optimization method of finding optimal solution based on evolutionary process. In applying genetic algorithm, we have to examine and know the exact properties of problems and decide on a proper depiction.

Fig 1.1: Flow diagram of Genetic algorithm

Mechanisms of Genetic procedure are as follows :

1.3.1 Initialization of parameter

First step of genetic algorithm is initialization of population. This step is start with a number of multiple solutions in form of chromosome. Chromosome is simply like the arrays which hold a number of values. In this step we initialize random chromosome according to our need.

1.3.2 Apply Selection Operator

Selection operator is used for choice of quality parents after a pool of solutions. Quality parents means having highest value of fitness value. We measure the fitness value in terms of survival rate. Each time some parents are selected from a pool of solutions through their fitness value.

1.3.2 Apply Crossover Operator

Individually time dual children are formed from two fittest individuals. These individuals are nominated since a group. A group is a place where a number of solutions offered that stayed chosen through choice operative. Border operative and alteration operator produce a kid that stake many properties of their paternities. Fresh paternities are nominated till a fresh population of purposes of suitable size is produced.

1.3.4 Apply Mutation Operator

Alteration is a procedure of altering the of minute arrangement to preserve genomic variety.

1.4 CUCKOO   SEARCH   PROCEDURE:

Cuckoo search process [1,2,14,15] is a minimization process which was developed in 2009. It is created upon the procedure of cuckoo birdies which lay their broods in the host birdie's nest. Some Birdies can distinguish the offspring of Cuckoo. If a host bird recognize the eggs, it will either throw of cuckoo's egg or it will abandon the nest.

Cuckoo search is mainly consists of three instructions:

1. Each cuckoo leaves only single egg at a period and leaves its egg in a arbitrarily selected host bird's shell.

2. The shells having higher survival rate of seeds will forward to the following generation.

3. The quantity of host shells is stable, and the egg placed by a cuckoo is recognized by the swarmwith a probability parameter P which lies in range from 0 to 1.

Host bird identify the cuckoo's egg on some set of worst nests which are not having good fitness value. Cuckoo search procedure is the best procedure among all the metaheuristic processes. Cuckoo search process is now being used to resolve numerous optimization problems. It is very fast algorithm as equate to other metaheuristic algorithm because it uses discrete a single factor for searching. It can be useful for various optimization difficulties due to its fast and efficient result as compare to other evolutionary algorithm. Result show that it can perform better than other metaheuristic algorithms in many applications because it use only a single factor for searching.

Cuckoo search algorithm uses the following representations for optimization problem:

Each egg signifies a result, and a cuckoo egg denotes a new result. Our leading goal to use novel and fittest egg in place of less fit. In the greenest practice, apiece shell has one egg. The procedure can be protracted to more difficult cases in which a nest can have several seeds indicating a fixed of results.

Main steps of Cuckoo search algorithm are as:

Step-1 Initialize the population of n host birds nest;

Step-2 While (stopping criteria)

Step-3 Get a cuckoo randomly and replace its solution by performing Mantegna algorithm;

Step-4 Calculate fitness value Fi

Step-5 Choose another nest among all nests randomly say it j;

Step-6 Evaluate its quality value called as Fj

Step-7 Compare fitness value of both cuckoos

Step-8 if fitness value of cuckoo I is greater than fitness value of cuckoo j

Step-9 Replace cuckoo j by the new solution;

Step-10Some proportion of nest having low fitness value will be abandoned and some new nest will be formed.

Step-11 Keep the fittest solution;

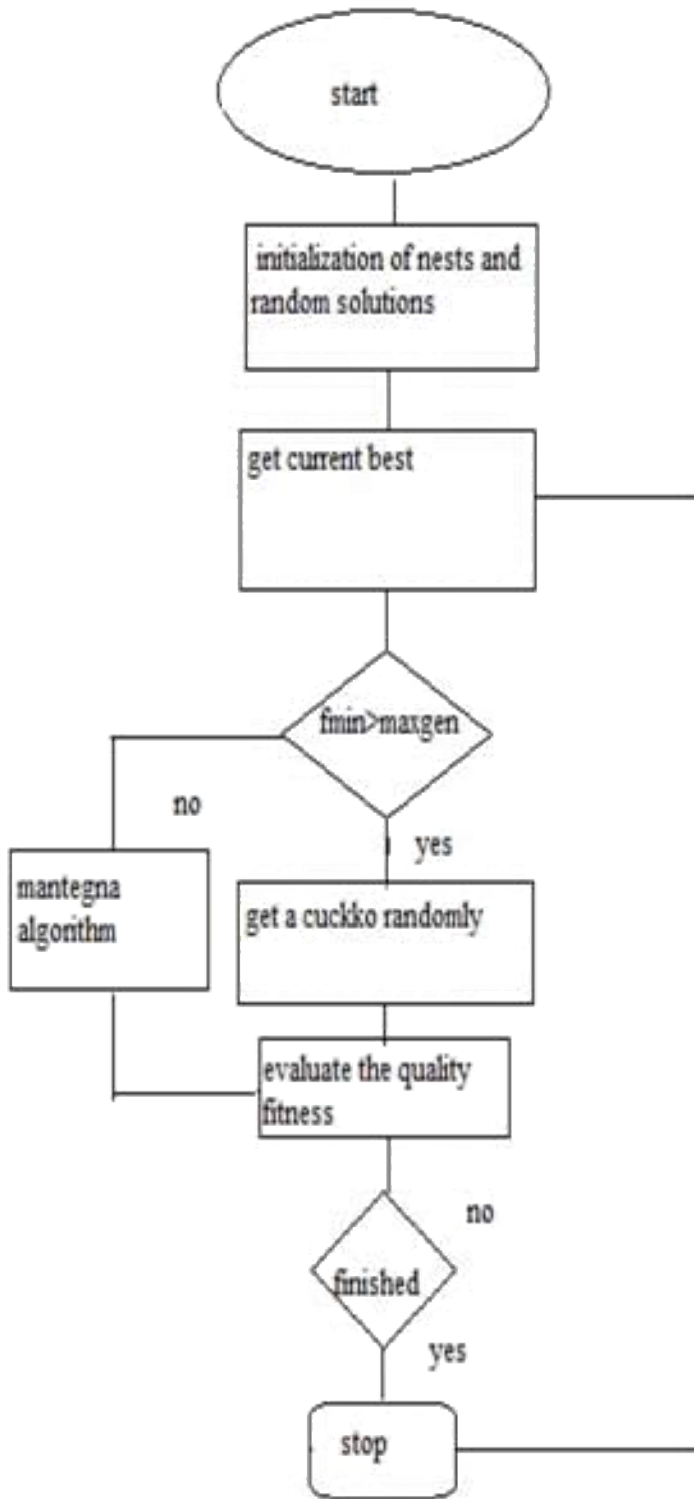Step- 12 Forward the current best solution to the future generation;

Step-13 End while

Fig 1.2: Figure of cuckoo procedure

Chapter 2
TERMINOLOGY:

Brood parasite birds- This kind of birds does not make nests for laying eggs. They lay eggs in other birds' nest. Ex- Cuckoo.

Combinatorial Problem- A combinatorial problem is that problem where an optimal ordering and selection of options is desired.

Cost - Time and space taken by algorithm for execution.

Hybrid- Merging of two algorithms.

Local Search- Local search is a metaheuristic method to solve NP complete problems. It moves from one solution to another in the search space till the time an optimum solution is not found or time is not over.

Metaheuristic algorithms- These algorithms are nature inspired algorithm. These kinds of algorithms are problem independent algorithms that can be applied a broad range of problems.

NP- Complete Problem- The problem for which we cannot find exact solution for a given input. In this kind of problem complexity increases rapidly as the input size are increases

REVIEW OF LITERATURE:

Suash Deb et al. [1] suggested a minimization procedure which is shaped near the usual occurrences of about cuckoo birdies.This procedure can be practised for optimization difficulties.This procedure executes well then further metaheuristic procedure outstanding to it's fast confined examination.

Mr. Rajesh C Sanghvi et al. [2] planned minimization cuckooexploration process.Cuckoo search procedure was implemeted with dissimilar procedure such as Mantegna procedure,Denial procedure and Mc culloch's procedure for arbitrary choice and it was establish that once cuckoo search examine procedure existed executed by the assistance of Mc culloch's procedure presentation of this algorithm was well than last double processes.

Ye LI [3] suggested a evoluationary procedure aimed at job arrangement.Here author proposed a unique method to characterize the primary result.Unique method was dual gene demonstration of primary resolutions then after useful boundary and variation operator.The method was realized on different numbers of taks and resources plus outcome exhibited that procedure has been useful to job arrangement excellently.

Essam Al Daoud et al. [4] planned a combination method through integration hint of genetic and cuckoo search method and this fusion procedure was smeared to drifting salesman delinquent.This fusion algorithm pools the benefit of together genetic and strange search procedure.Difficulty using genetic process is that it simply stuck in limited goals so to remove this trouble strange search procedure was castoff to expand the presentation of process.Cuckoosearch method is actual profligate process and it usages single a solo factor Pa for probing.Cuckoo search offers profligate and effective result as match to other processes.

P. Dhavachelvan et al. [5] suggested a fusion process that comprises dual process ant society optimization and Cuckoo examination procedure.This jumble process faiths the advance of both process ant colony optimization and cuckoo search process.

Agus Darmawan et al. [6] suggested a optimization process founded on natural method for stream task preparation.Task   preparation is the allocation of means to the tasks.In job arrangement problem,number of jobs and numbers of machines should not be equal.A piece work should covers the number of processes identical to the number of machines.Key objective of procedure was to diminish the completion time.Genetic procedure with nearly variation was useful to the job arrangement delinquent.

In this paper genetic process and some traditional further procedures were practical to equal number of machines and jobs.Result show that presentation of improved genetic procedure was higher than as match to other three approaches.

Abdul Munem Khan et al. [7] suggested a dissimilar method aimed at resolving work shop arrangement.In today's scenerio work arrangement is become vital amount of engineering area.genetic process was applied with the assistance of scheduler to resolve job arrangement delinquent in engineering.The suggested process can be practical in numerous arena because it was field self-governing.Some average usual of difficulties that has been previously answered in earlier examination documents were reserved in to interpretation for evaluation.Outcome expression that it's presentation was improved than as comare to old procedure. One more gain of suggested procedure is that some variation can be ended eaisly agreeing to the wants of the problem.

M. S Morshed et al. [8] suggested a circumstance learning of work arrangement by benefits of genetic and tabu exploration method.In this exploration broadside a jumble method by addition of genetic and tabu scrutinize process is united.The resolution of intense such a jumble process by method of in the condition of numerous arrangements which follow Genetic process also Tabu exploration is to combination the overall quest and restricted exploration charactarstic of Genetic procedure and Tabu exploration process separately. The jumble process expected in this broadside is very appropriate for conclusion result of some convention difficulties and natural existence difficulties.

Omar Al Jadaan et al. [9] suggested job arrangement in network calculating.In this broadside, a robust process using pretend hardening and genetic process was used.An alteration centred pretend hardening and associate suggested process with vigorous genetic scheduler for network computing was proposed. Outcome shown that alteration based pretend strengthening does well than vigorous founded genetic scheduler for network calculating.It reduces the complete time more as match to vigorous based genetic scheduler.

Devika Suseelan et al. [10] planned a improved genetic procedure .In this broadside Writer finds out an operational agenda for job action.It befits very crucial to generate an effective schedule of process of tasks when there is a restricted resources present.In this broadside Writer applied a manual role in its place of single point boundary and double point boundary.Due to this manual function in abode of alone point and double point boundary operator Writer finds out an optimal allocation of operation with decrease in completion time.
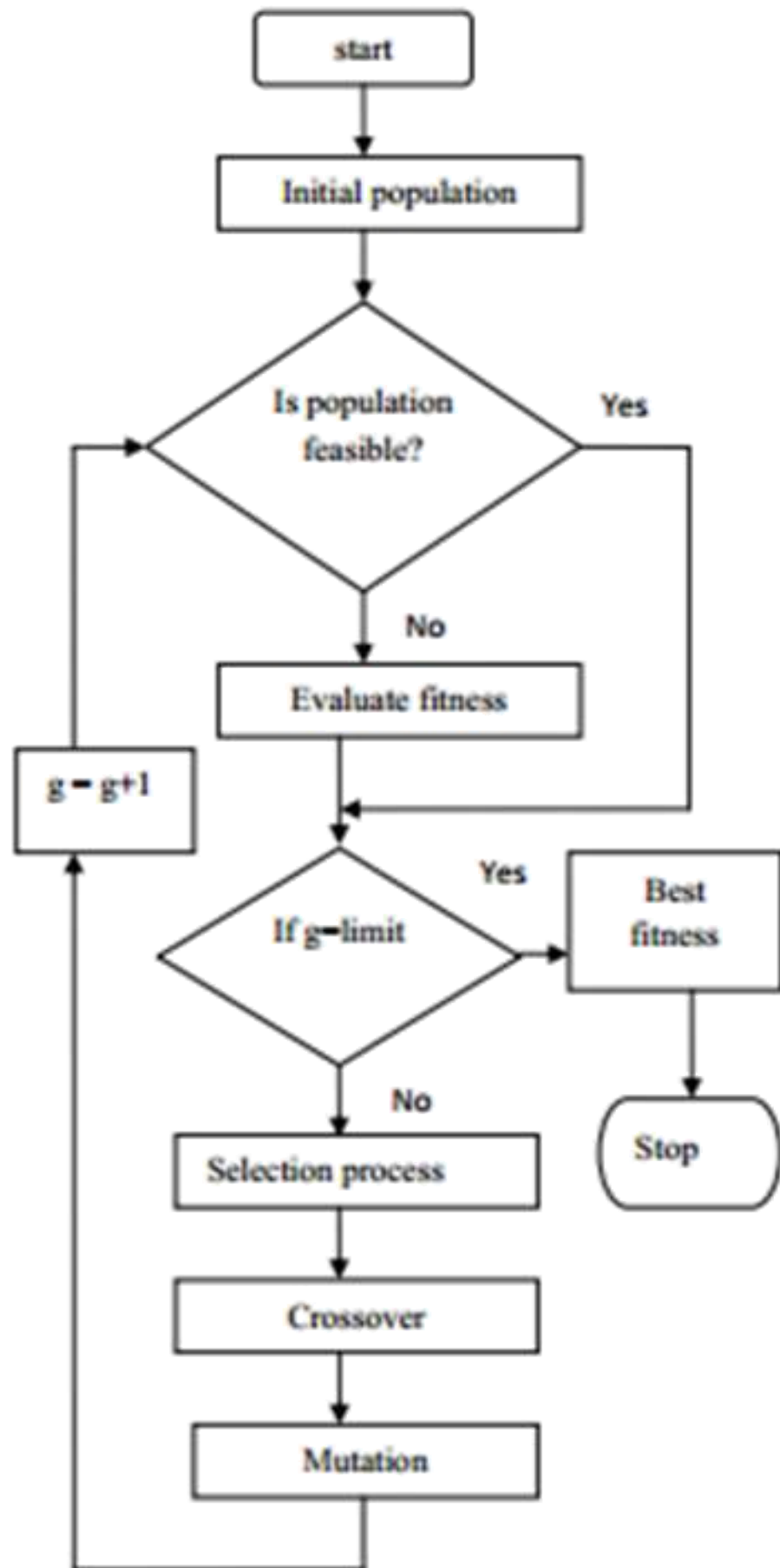
Fig 3.1:Flowchart of Genetic algorithm with fitness values

Chengsheng Pan et al. [11] suggested a genetic algorithm.In this broadside Writer planned a genetic procedure for preparation of resources in a cable grid.It grows very critical to discover out the finest plan in cable grid because resource of grids are of very great price.Result discover out that natural procedure can novelty well plan as relate to old methods.
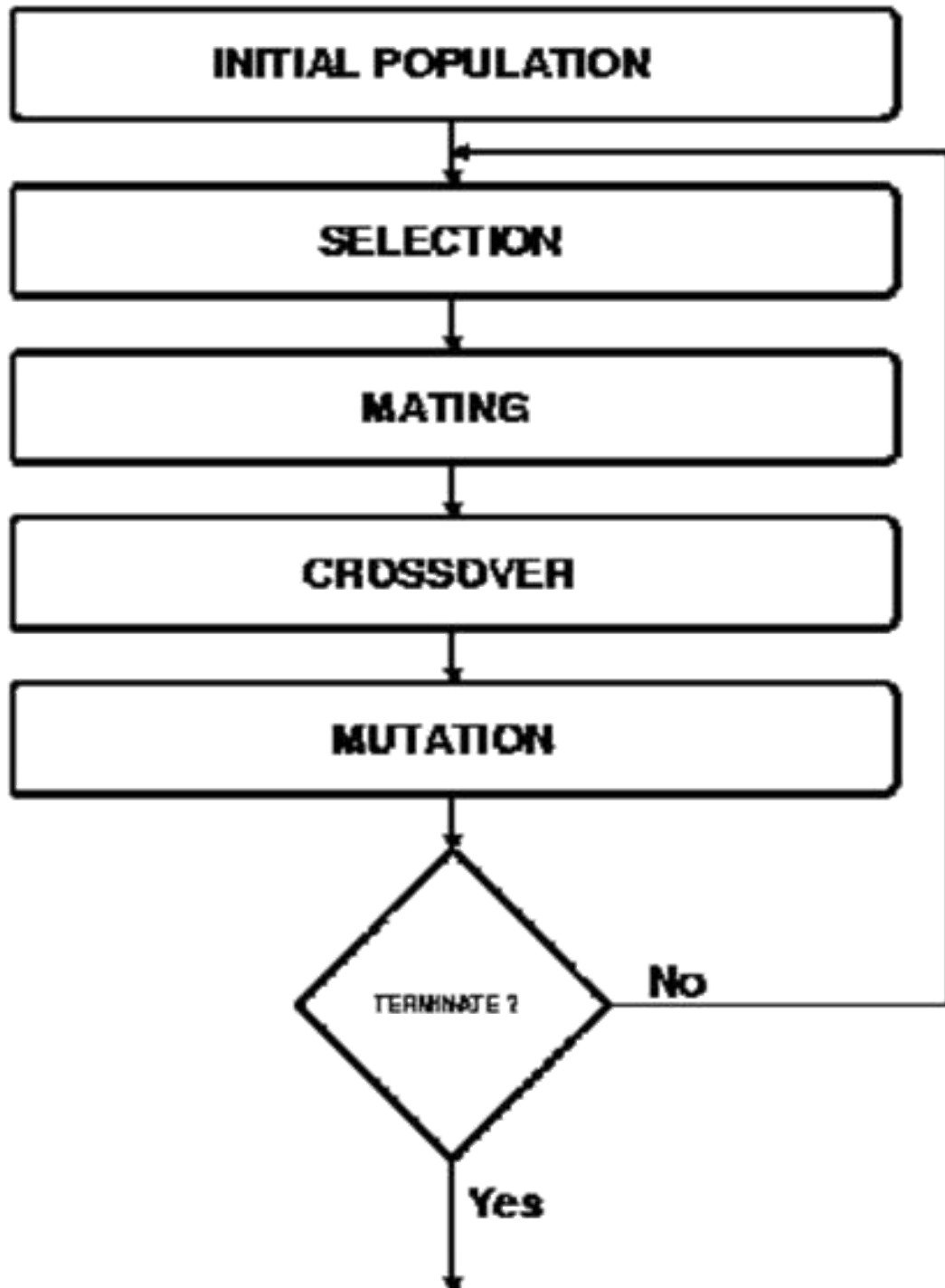

Fig 3.2:Flow chart of Genetic optimization

Yasuhiro Tsujimura et al. [12] planned a different scheme using natural procedure for resolving task shop difficulty job preparation difficulty is the firmest tricky in np complications.In this paper a natural method over about adjustment was practical to the task shop preparation tricky and it was establish that it delivers healthier outcome as match to old branch and bound. Adapted genetic procedure delivers improved rapidity up for huge measure difficulties as match with branch and bound process.

Hedieh Sajedi et al. [13] suggested a genetic cuckoo optimization procedure to improve the fitness of cuckoosearch process.Genetic cuckoooptimization procedure discover improved finest search universe as match with cuckoo opimization process.

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Ramin Rajabioun [14] suggested optimized peculiar quest procedure. Writer has advanced this optimization process by stimulating egg placing performance of peculiar fowl. Outcome of this procedure is linked with normal natural process and Unit group optimization procedure and it offers improved general best realization as well as quicker merging degree. The merging rate delivered by Cuckoo optimization algorithm is in less repetition than natural process and unit group optimization procedure. Extensive theme diagram of intended Cuckoo Optimization Method is revealed in underneath figure-
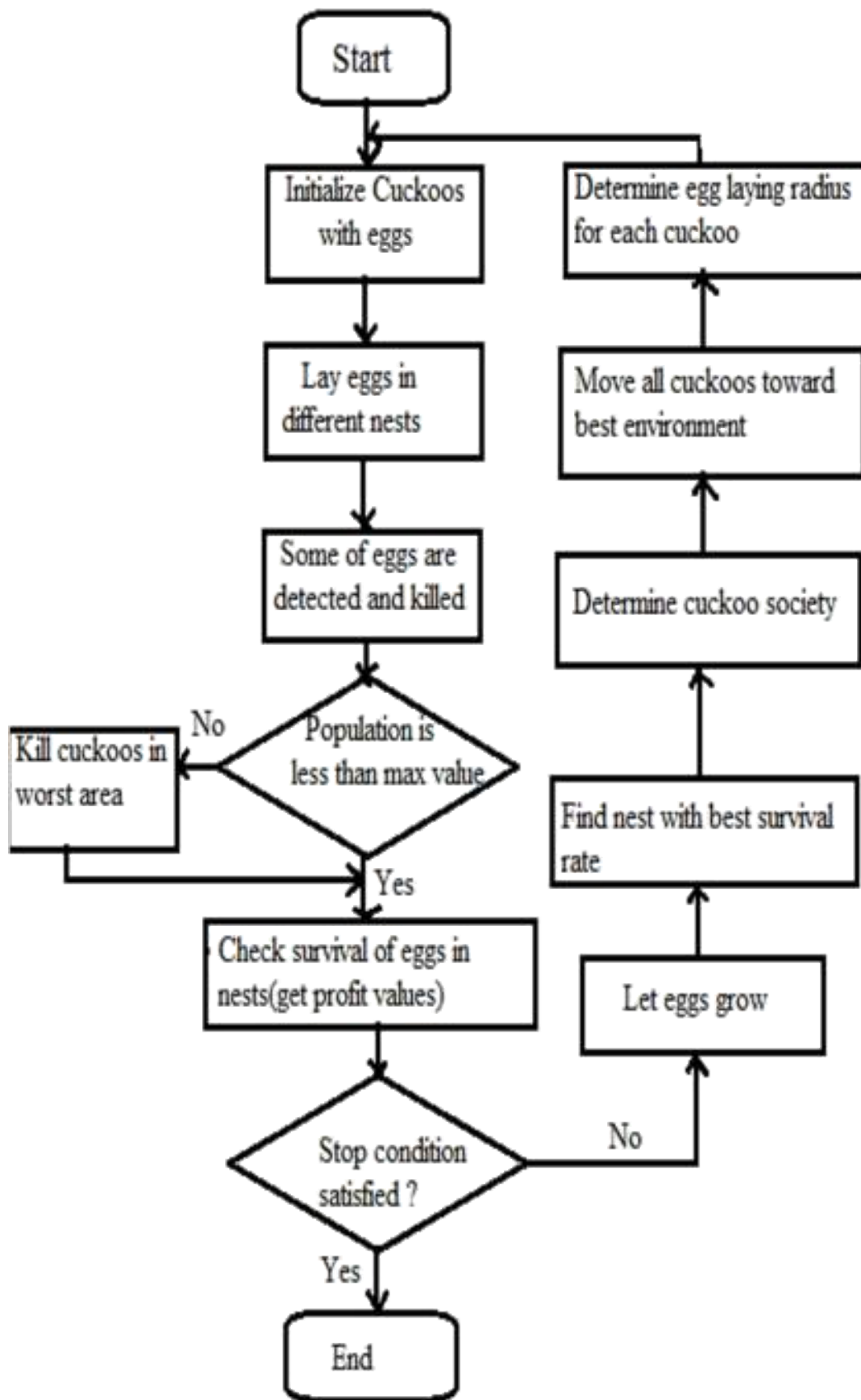
Fig 3.3: Modified cuckoo search procedure

Belaid Ahiod et al. [15] suggested a distinct kind of peculiar examine method to explain travelling salesman problem. In this method writer has announced new classes of cuckoo's populace that is precise in influence to solve nonstop difficulties along with combinatorial complications. In this process writers have announced new fraction p_c to increase the results of present pursuit. Cuckoos travel from lone zone to additional by impose hops. The main benefit of novel procedure is that it finds finest result in each area devoid of duping in confined optimum.

Ala'a Abu-Srhan et al.[16] suggested a hybrid algorithm for traveling salesman problem. In this paper author combines the advantages of both genetic and cuckoo search algorithm. Traveling salesman problem is a np – hard problem and many algorithm has been applied to solve it .Genetic algorithm provides better result as compare to other algorithms. But difficulity of trapping in local optima makes it unsuitable for solving np – hard problem. Problem with genetic algorithm is that it can be easily trapped in local optima so to remove this problem author used cuckoo search algorithm which is very fast and efficient algorithm. Cuckoo search algorithm is an efficient algorithm and uses a single parameter for searching.

M. Z. Rashad et al.[17] suggested a genetic cuckoo optimization algorithm for improving speed in solving optimization algorithms. Author suggested a hybrid algorithm by considering optimization as main factor. The proposed algorithm can be applied in many fields.

B.Radha et al.[18] suggested a genetic algorithm with local search for job scheduling problem in grid computing. Grid computing is simply a set of systems and resources. When the question of assigning resources to systems is arise then it becomes most crucial problem in optimization. When there is equal no of resources and systems there should not be any difficulty in assigning resources .But when there are different numbers of systems and resources then it becomes quite difficult that how to assign a resources to a system. Author uses genetic algorithms with local search techniques that help in finding optimal solution. Proposed hybrid algorithm was applied to 100 jobs and 20 resources and result was compare with genetic algorithm.it was found that result of genetic algorithm with local search was better than genetic algorithm.

Sangita Roy et al.[19] proposed a review on cuckoo search algorithm using levy flights. Cuckoo search process is a minimization process which was developed in 2009. It is created upon the procedure of cuckoo birdies which lay their broods in the host birdie's nest. Some Birdies can distinguish the offspring of Cuckoo. If a host bird recognize the eggs, it will either throw of cuckoo's egg or it will abandon the nest. Host bird identify the cuckoo's egg on some set of worst nests which are not having good fitness value.

Cuckoo search procedure is the best procedure among all the metaheuristic processes. Cuckoo search process is now being used to resolve numerous optimization problems. It is very fast algorithm as equate to other metaheuristic algorithm because it uses discrete a single factor for searching. It can be useful for various optimization difficulties due to its fast and efficient result as compare to other evolutionary algorithm. Result show that it can perform better than other metaheuristic algorithms in many applications because it use only a single factor for searching
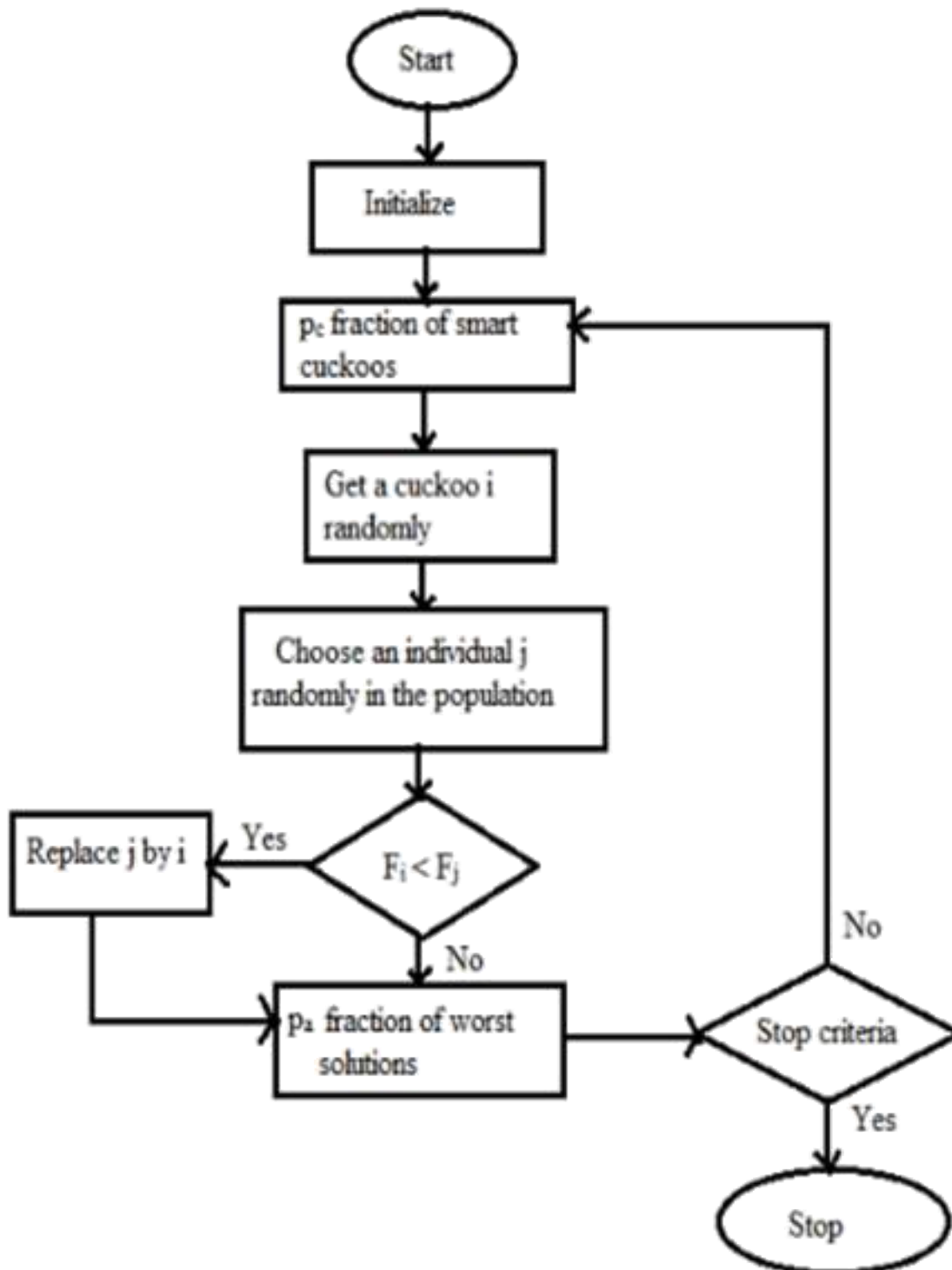

Fig 3.4:Flow chart of RKCS algorithm

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Ren Qing-dao-er-ji et al.[20] suggested a hybrid genetic algorithm for job shop scheduling problem. Job scheduling is a NP-hard tricky.NP –hard difficulty is a set of all decision problem for which no result occur in polynomial time but answer can be verified in polynomial time. Job scheduling is the method of allocating resources to the several jobs. Importance has been on exploring machine arrangement difficulties where jobs characterize activities and machines denote resources. Each machine can practice at most one task at a time. Representation of individual is the most critical task of genetic algorithm. Representation is equivalent to find a graph. In this paper author proposes a new scheme for representation .Each job consist a substring which composed of a number of operations. Number of operation may be less or equivalent to number of resources but it should not be greater than no of resources. There are some constraints Jobs are restricted. All jobs hold a set of operations that needs to be performed. Machines should be restricted. Each machine is capable of controlling only one procedure at a time. To solve the job shop scheduling more efficiently, a mixed selection operator based on the fitness value and the focus was designed in order to rise the variety of the population. Crossover operator based on the device, and alteration operator based on the critical path were designed according to the graph model of job shop scheduling problem. To calculate the critical path, a novel algorithm was offered. A confined search operator was intended in order to increase the quality of the results. Constructed on these algorithm was projected, and the merging of hybrid genetic algorithm to the universal optimal result in finite generation with probability 1 is verified. Then the merging of hybrid genetic procedure to the optimal solution with probability 1 is proved. The tentative results show that the projected algorithm is effective and performs better than the existing algorithms

Imran ali chaudhry et al.[21] suggested a genetic algorithm for minimizing makespan for a no wait job shop. Author explains concept of minimizing makespan or total elapsed time of jobs, no-wait job shop scheduling. General purpose genetic algorithm was designed for no wait job shop scheduling problem. The result analysis show that genetic algorithm produces better result than previous existing algorithms.

Wael Abdulal et al. [22] suggested a hybrid algorithm using simulated annealing and genetic algorithm for task scheduling in grid environment. Grid environment is simply a collection of systems and resources. Grid computing means a sharing of resources and data at broader range. Main problem in grid environment is to achieve high performance so that each system can get a resource on time. As in grid environment resources are in sharing mode so it becomes most crucial task that after completion of a particular task of a particular job it should be free so that another system can use it to complete it's task.

Shaminder Kaur et al. [23] suggested a genetic algorithm for solving job scheduling problem in cloud computing environment. Cloud means a pool of resources. In this paper author explains the concept of task scheduling in cloud computing field. Cloud computing is used in organizations for consumption of resources when they require.In providing cloud services the task should be scheduled in such a way there should be

reduction in execution time and execution cost. The result analysis show that proposed algorithm produces good result under heavy load.

Xin-She Yang et al. [24] proposed Cuckoo Search algorithm which uses levy flight for step size. In this paper author has formulated a new metaheuristic algorithm named as Cuckoo Search (CS) with levy flights to solve optimization problems. Cuckoo search works based upon the breeding behaviour of cuckoo bird. This algorithm works better than PSO (Particle Swarm Optimization) and GA (genetic algorithm). The main advantage of CS is that it has only two essential parameters, population size n and probability function p_a. More importantly we don't need to fine tune these parameters according to the problem. Apart from it this algorithm makes local search faster as well.

OBJECTIVE OF STUDY:

Job scheduling is simply a process of assigning resources to jobs. The problem of job scheduling is arises when there is number of jobs are more than resources then it becomes a tricky problem. Main task of job scheduling is to provide the resources to jobs in such a fairly manner that it should not affect other jobs.

Many algorithms has been applied to job shop scheduling problem. Almost all metaheuristic algorithms have been applied to solve job shop scheduling problem. Genetic algorithm provides better results as compare other metaheuristic algorithms but problem with genetic algorithm is that it becomes easily stuck in local optima so to avoid this problem we are using cuckoo search algorithm. Cuckoo search algorithm is efficient and fast algorithm and it uses a single parameter for searching. We are using hybrid genetic and cuckoo search algorithm for solving job shop scheduling.

3.2 OBJECTIVE OF STUDY:

Our leading objective is to diminish completion time of Job scheduling problem .We have scheduled a merging procedure that groups the benefits of both Genetic and Cuckoo search process. Leading difficulty of genetic process is that it can simply be confined in limited optima so to remove this problem we are applying cuckoo search procedure. Fusion algorithm plans the job more accurately as matches with genetic procedure. We will apply genetic and our planned hybrid procedure for task scheduling and compare hybrid procedure to genetic procedure.

Main impartial of the study:

- Algorithm should not trap in the local minima.
- Algorithm should perform local search fast.
- Algorithm should provide better results to NP-hard problems.
- Algorithm should optimize the problem heuristically.
- If the size of the problem is increased the complexity should not increase.
- To find always a faster global best solution.
- Reduction of the search space.

Chapter 5

SCOPE OF STUDY:

In this paper we have developed a fusion procedure for reduction in completion time. In forthcoming time new factors can be supplementary to improve the enactment of planned method .We will apply this planned procedure for task arrangement. This proposed method can also be recycled for resolving new optimization difficulties that comes under NP-complete problem. Our suggested method styles confined search more rapidly by Cuckoo Search. In coming time some variation can be done to improve the presentations of our planned method.

RESEARCH METHODOLOGY:

5.1 Existing System:

Genetic algorithm is a good algorithm to solve job scheduling problem. Genetic algorithm is evolved from natural process. It is based on natural phenomena. Genetic algorithm provides better result as compare to other optimization algorithm. Genetic algorithm is easy to implement.

5.2 Problem faced by Genetic algorithm

Problem with genetic algorithm is that it can be easily trapped in local optima. Local optima means it gives different-different result for same input parameter. So This problem makes Genetic algorithm unsuitable to solve job scheduling problem.

5.3 Proposed System

We have developed a hybrid procedure that joins the advance of both genetic algorithm and cuckoo search algorithm. Genetic algorithm has been already applied to job scheduling but difficulty with genetic algorithm is that it can be normally trapped in confined optima. Confined optima means it provides variation in results within some set of values for same input values for different runs. So to remove this problem of genetic algorithm we are using cuckoo search procedure that is very profligate and effective algorithm. And use only solo parameter for searching.

Stages of procedure are as follows:

Scheduling procedure:

1. Initialization of parameters.
2. Enter the number of tasks and resources
3. Plans the tasks using proposed method
4. Calculate completion time of tasks
5. All task allocated if yes go to stage 6 else go to stage 3
6. Stop

Genetic algorithm:
1. Initialize current generation
2. While(condition)
3. Apply limited search using cuckoo search process.

4. Apply Choice operator for choosing double fittest solution every time

5. Apply Boundary operator to yield new child

6. Alteration operator is used to maintain genetic variety

7. Stop

Cuckoo search algorithm:

Step-1 Initialize the population of n host birds nest;

Step-2 While (stopping criteria)

Step-3 Get a cuckoo randomly and replace its solution by performing Mantegna algorithm;

Step-4 Calculate fitness value Fi

Step-5 Choose another nest among all nests randomly say it j;

Step-6 Evaluate its quality value called as Fj

Step-7 Compare fitness value of both cuckoos

Step-8 if fitness value of cuckoo I is greater than fitness value of cuckoo j

Step-9 Replace cuckoo j by the new solution;

Step-10 Some proportion of nest having low fitness value will be abandoned and some new nest will be

Step-11 Keep the fittest solution;

Step-12 Forward the current best solution to the future generation;

Step-13 End while

Benefit of genetic algorithm:

- It can resolve at all boost difficulty that can be represented in chromosome coding.
- This algorithm is begin with a number of results.
- Genetic procedure is a method which is very simple to grasp and it does not demand of extra knowldge of mathmatics.

Drawbacks of genetic algorithm:

- It can be simply stuck in confined bests.
- Some optimisation difficulty that can not be denoted as gene coding can not be answered by this procedure.

Benefit of cuckoo search algorithm:

- It's profligate and effective as match with other metaheuristic procedure.
- This algorithm uses only a solo factor for probing.
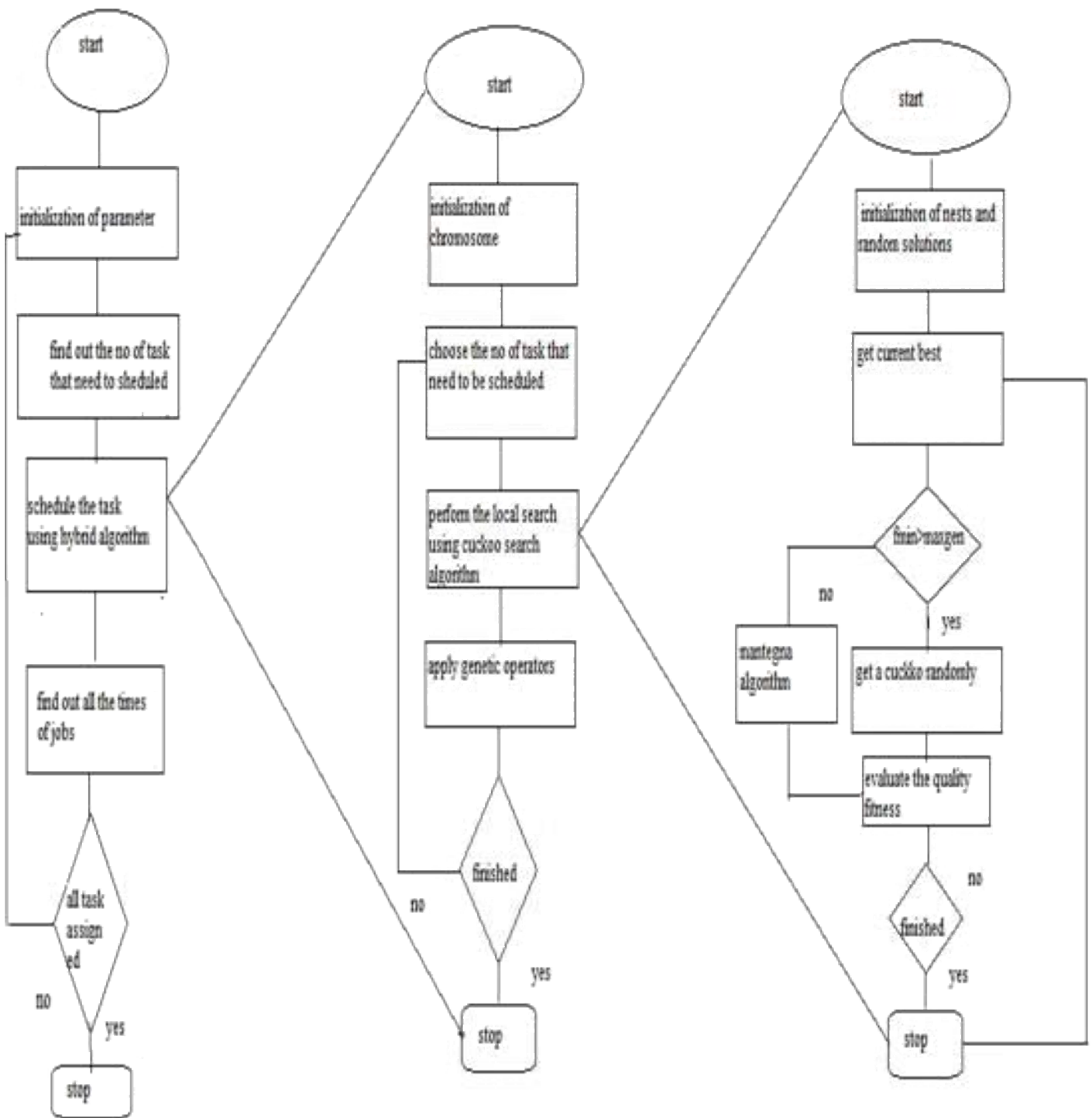- This algorithm offers universal outcome.

Fig 6.1: flow diagram of suggested hybrid algorithm

chapter 7
RESULTS AND DISCUSSION :

Experimental Setup:

For every algorithm some control parameters are used for its efficient working. Hence, there are some control parameters for genetic algorithm with cuckoo search which is our proposed algorithm. We did an extensive literature survey to find out the specific values of these control parameters. From this we found that the values which we have taken in this experiment are standard values and they are also suitable for this experiment. The control parameters of Genetic algorithm are p_c (crossover probability), p_m (mutation probability), and In cuckoo search value of p_a is taken from 0 to 1. Foe mantegna search the value of alpha is taken from 0.3 to 1.99. The next parameter in our experiment is maximum number of population and we have taken its value to be 10 to 100.

Experimental Results:

We compared our proposed hybrid algorithm with genetic algorithm .Result analysis show that performance of our proposed algorithm is better than the genetic algorithm

Input parameter:

Number of resources=[3,6,7]

Number of jobs= [6,16,17]

```
   -4.6606     0.2716     4.2632     1.1375    -1.0787    -0.6067     0.8429    -0.3864    -1.5546

   Columns 10 through 15

   -1.7895     4.8411     1.7337     0.8239     2.4740    -1.8339

Total number of iterations=0
best fun      4.5074

fitness   Columns 1 through 9

   -4.3540     0.9284    -1.5440     1.6002     0.7788     0.5255    -1.2849    -3.5754     1.9059

   Columns 10 through 15

    4.5074     0.0090    -2.0257     1.5812    -0.0715     0.3107


Time taken by hybrid     0.3954
    0.5137
    0.5586


Time taken by Existing    5.3191
    1.4609
    1.7534

fx >>
```

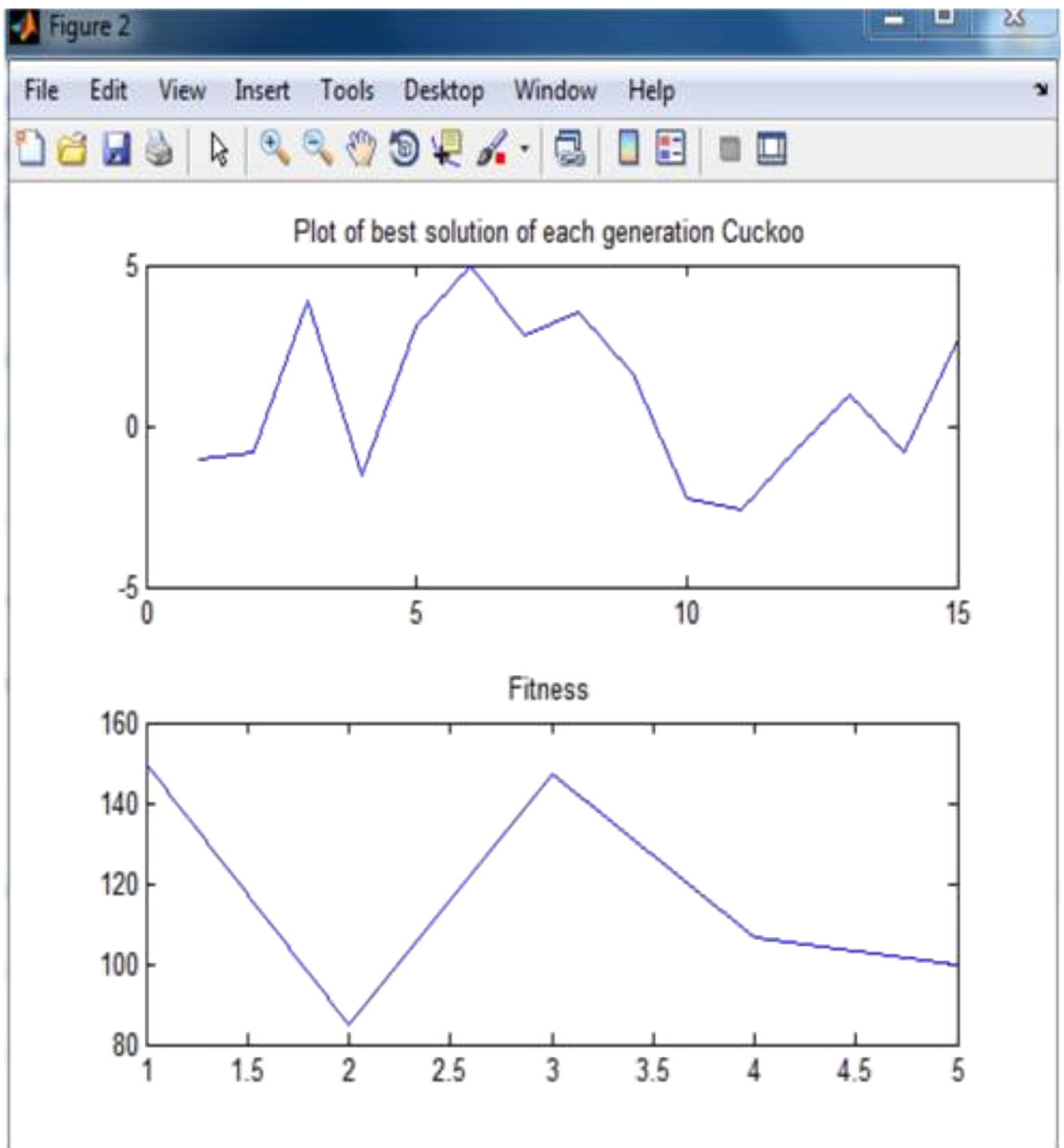Fig7.1: time taken by genetic algorithm and hybrid algorithm

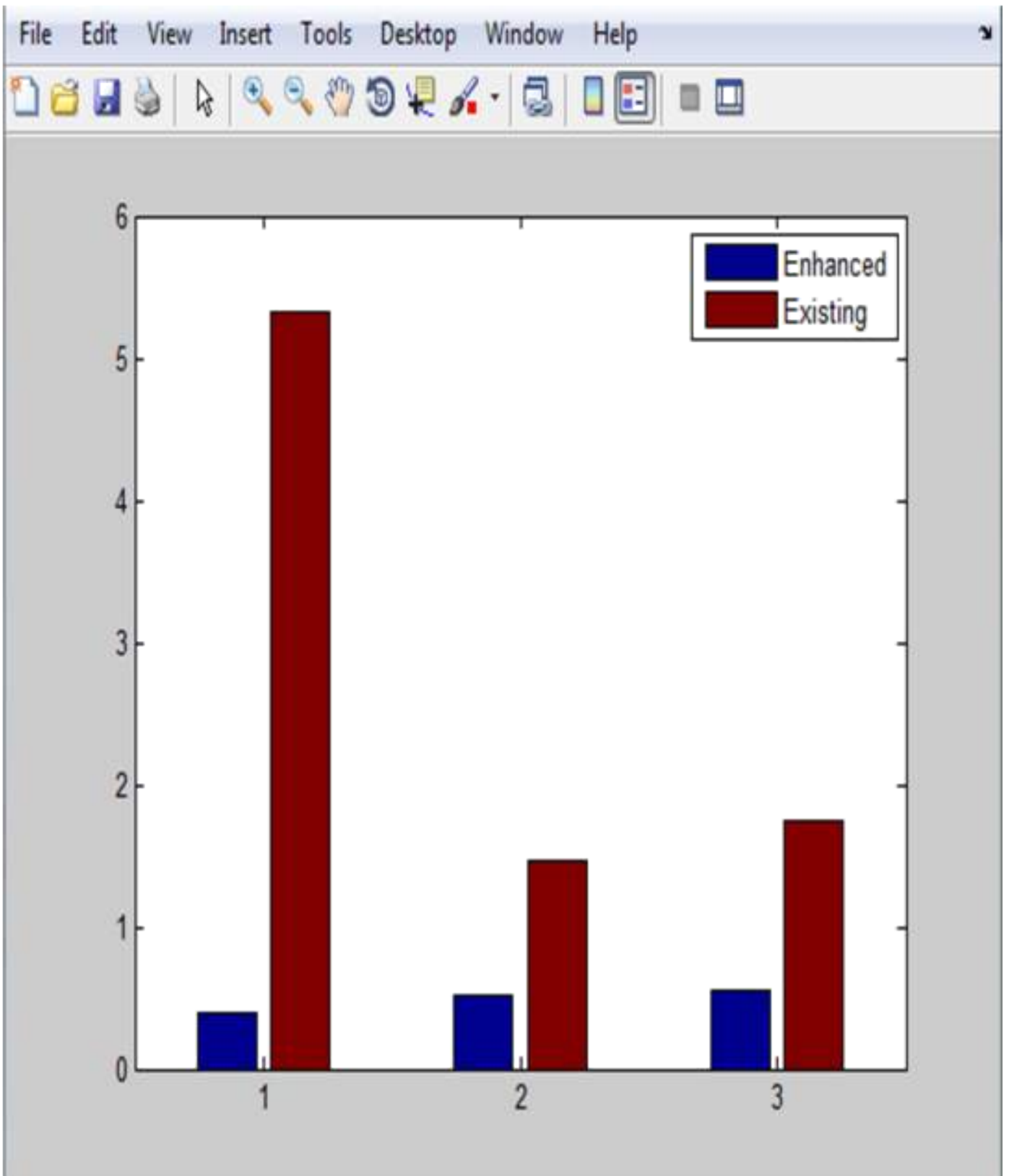Fig 7.3:best solution of cuckoo search algorithm

Fig 7.3:bar chart of time taken by genetic and proposed algorithm
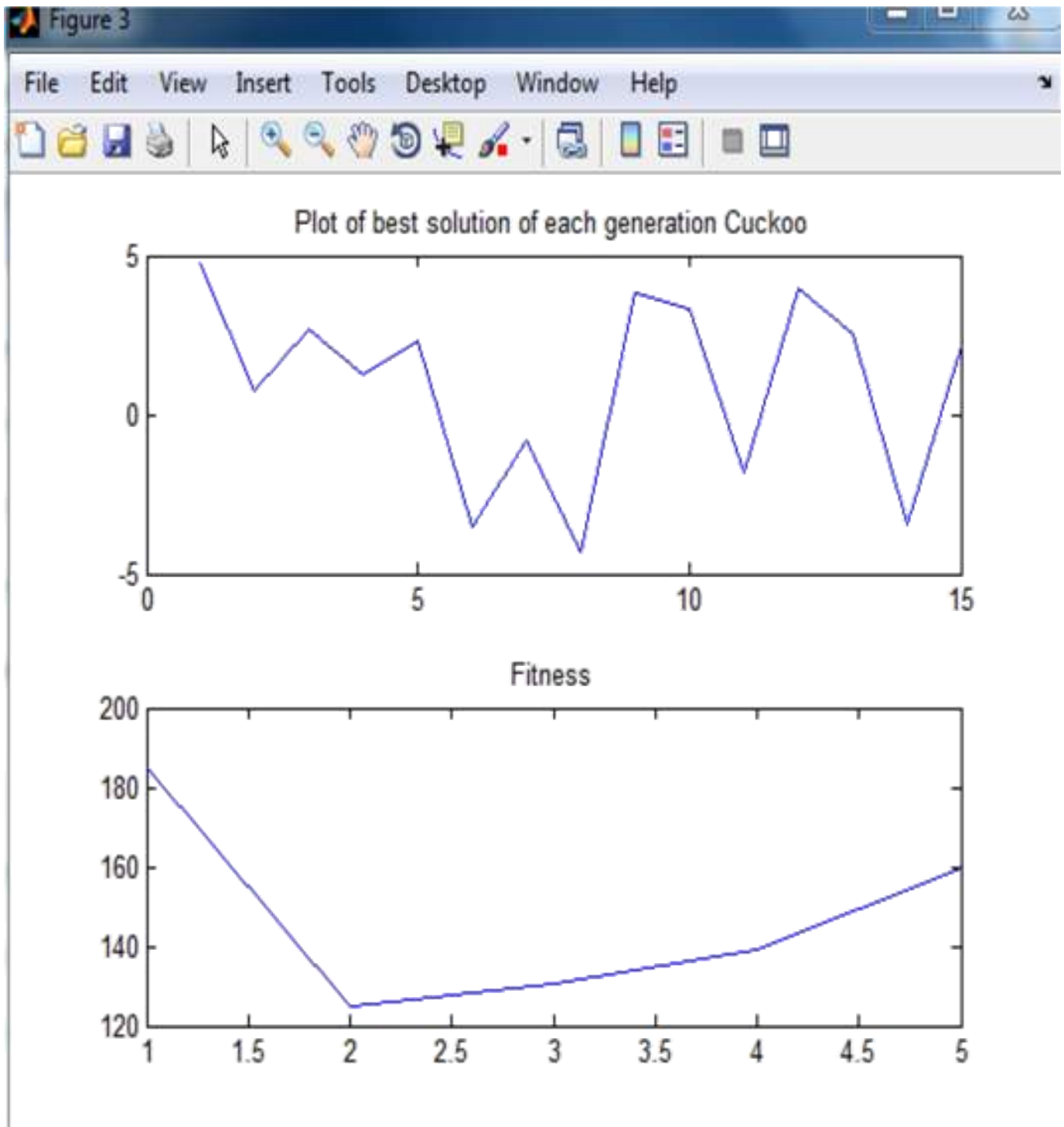
Fig 7.4 best solution of cuckoo search algorithm

Input parameters:

Number of machines=[4,7,8]

Number of Jobs=[7,17,18]

```
Command Window

     4.2017    3.7685    4.2933   -3.3174   -0.7846   -1.3819    0.0222    2.3750   -4.7690

  Columns 10 through 15

     2.2213   -0.6735    0.1188    1.4949   -3.5652    1.4579

Total number of iterations=0
best fun    4.3857

fitness  Columns 1 through 9

   -4.9792   -0.2563   -0.9953    0.1117    4.1909   -1.3414    4.3857   -0.3980    0.0641

  Columns 10 through 15

     2.3259    3.6378   -0.2001    0.0248    1.2577    3.6006


Time taken by hybrid    0.3724
    0.5305
    0.6083


Time taken by Existing    1.2083
    1.2348
    1.5089

fx >>
```

Fig 7.5: Time taken by genetic and proposed algorithm

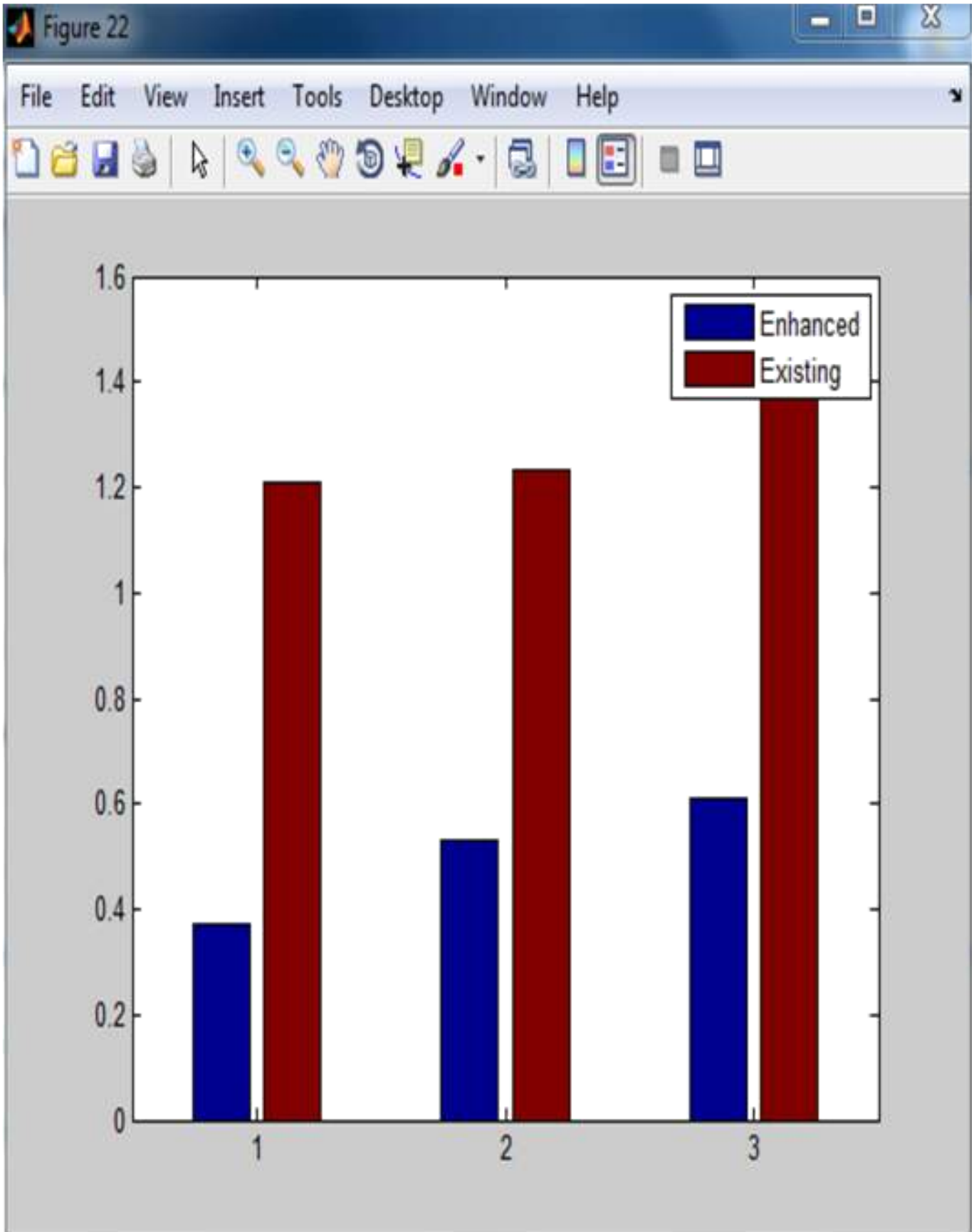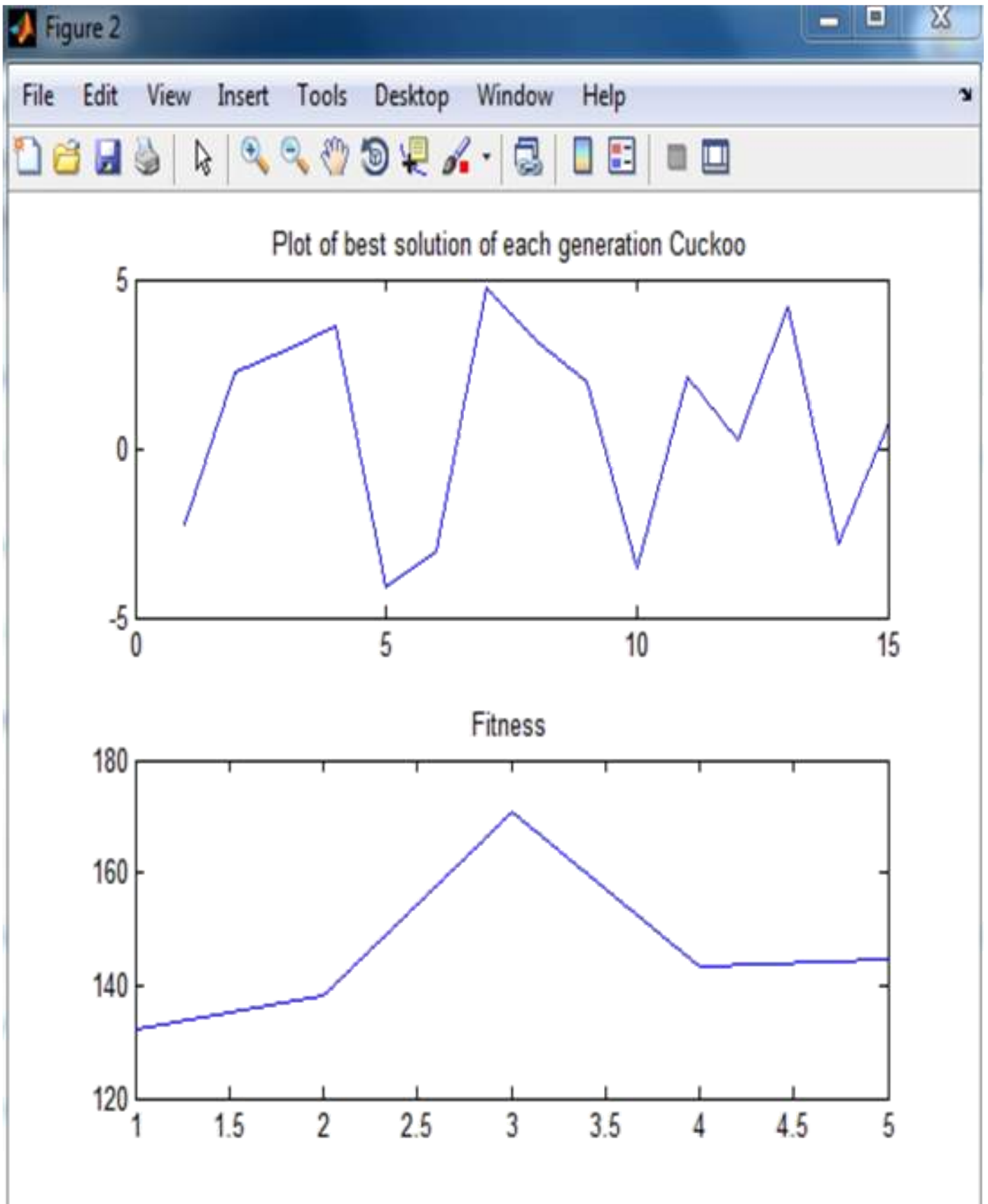Fig 7.6:bar chart of time taken by genetic and hybrid algorithm

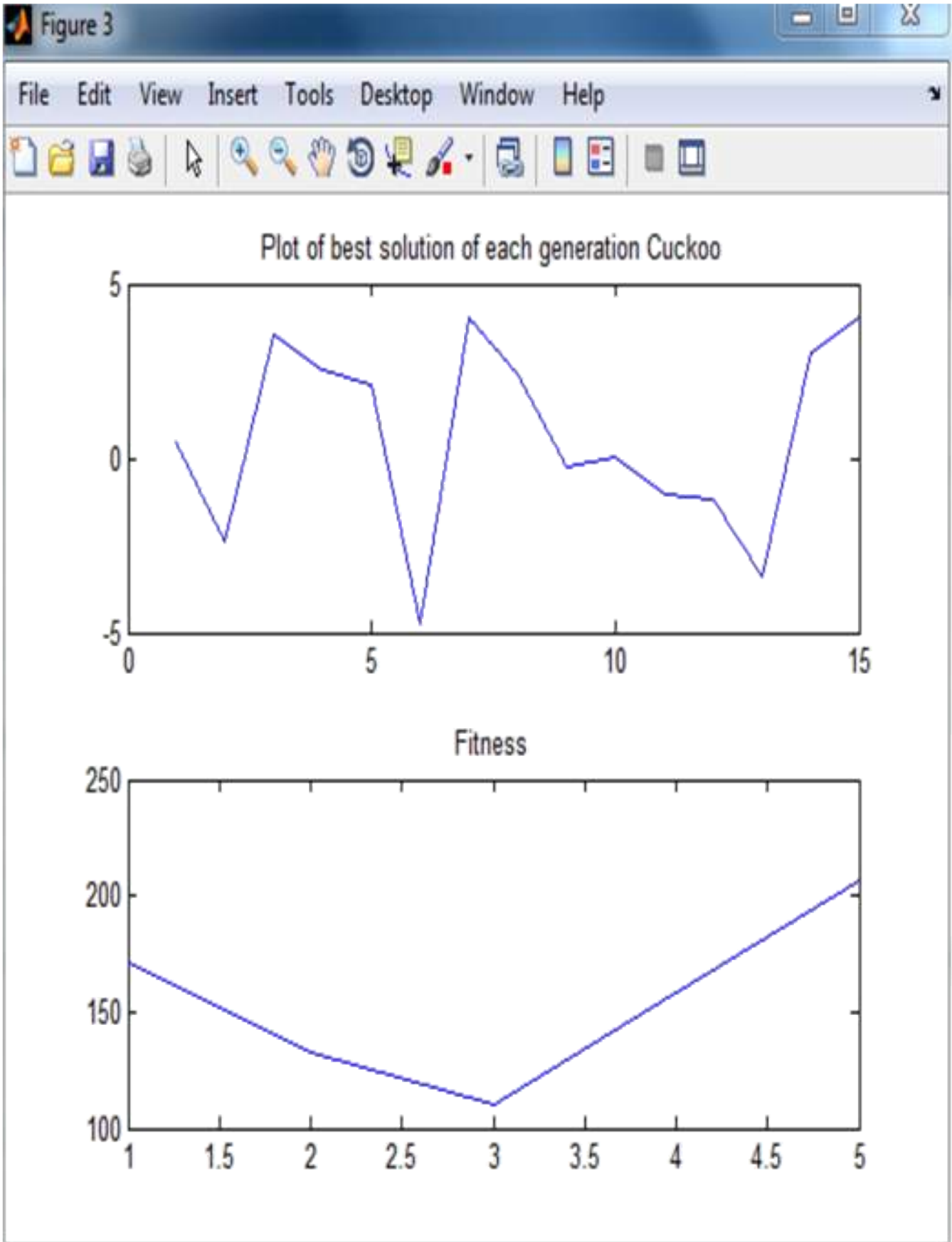Fig 7.7: best solution of cuckoo search algorithm

Fig 7.8 :best solution of cuckoo search algorithm

Input parameters:

Number of machines=[5,8,9]

Number of jobs=[8,19,20]

Maximum number of generations=5

```
Command Window                                                                    ⊙
    -0.1176    -2.2853    4.9163    1.5782    0.5633    2.2421    -2.4855    0.4738    -1.7637

   Columns 10 through 15

    3.9289     4.4625    3.9121    0.7866    -1.1805    -1.9969

Total number of iterations=0
best fun    4.4867

fitness  Columns 1 through 9

    2.5471    3.6159    2.7216    4.2461    -1.0054    3.6977    -2.2350    3.1672    4.4867

   Columns 10 through 15

    1.7153    -1.0200    -0.2644    -1.5163    -0.1019    -3.4530


Time taken by hybrid    0.4217
    0.5779
    0.6081


Time taken by Existing    1.6404
    1.2504
    1.5749

fx >>
```

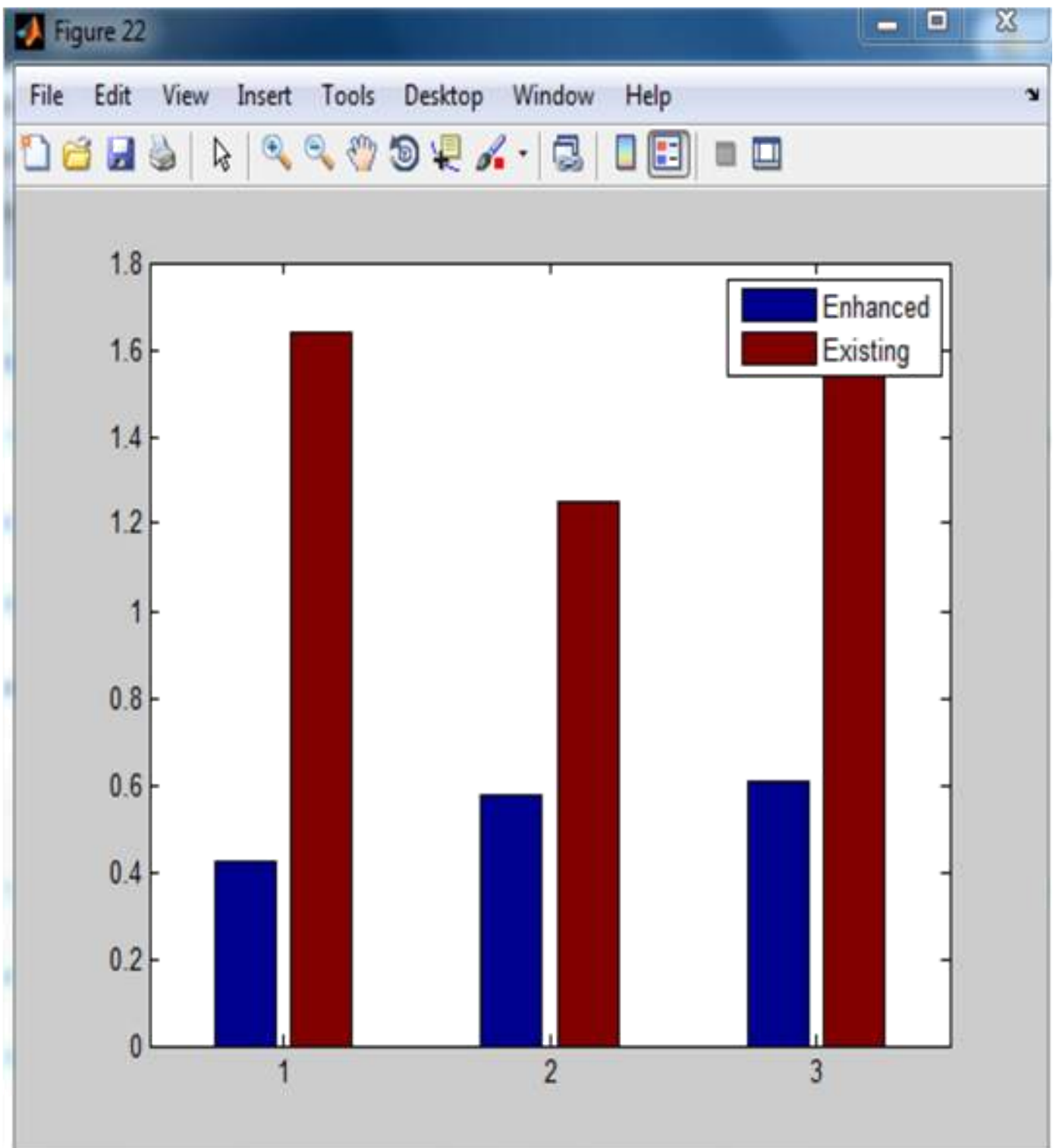Fig 7.9:Time taken by genetic and hybrid algorithm

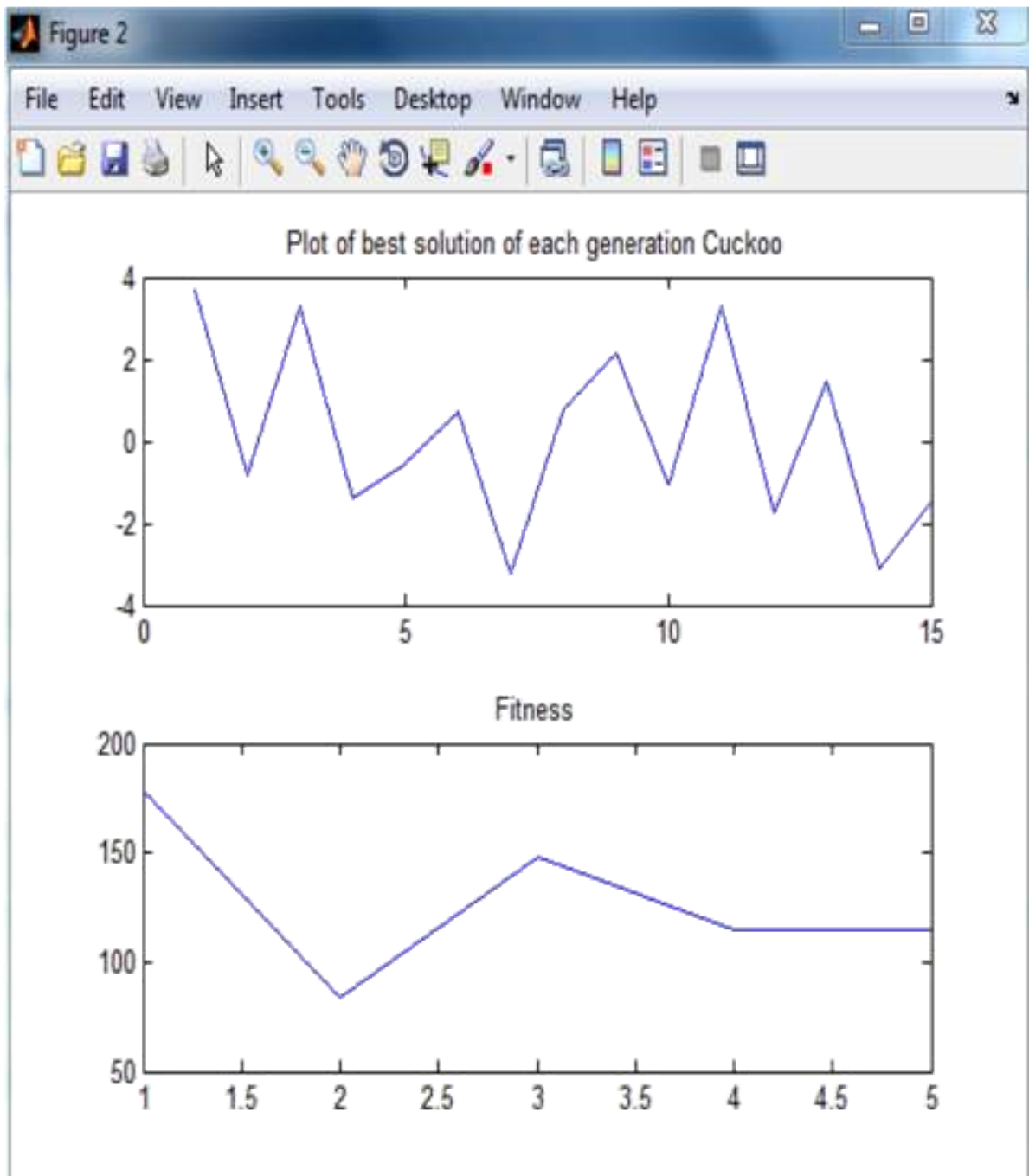Fig7.10: bar chart of time taken by genetic and hybrid algorithm
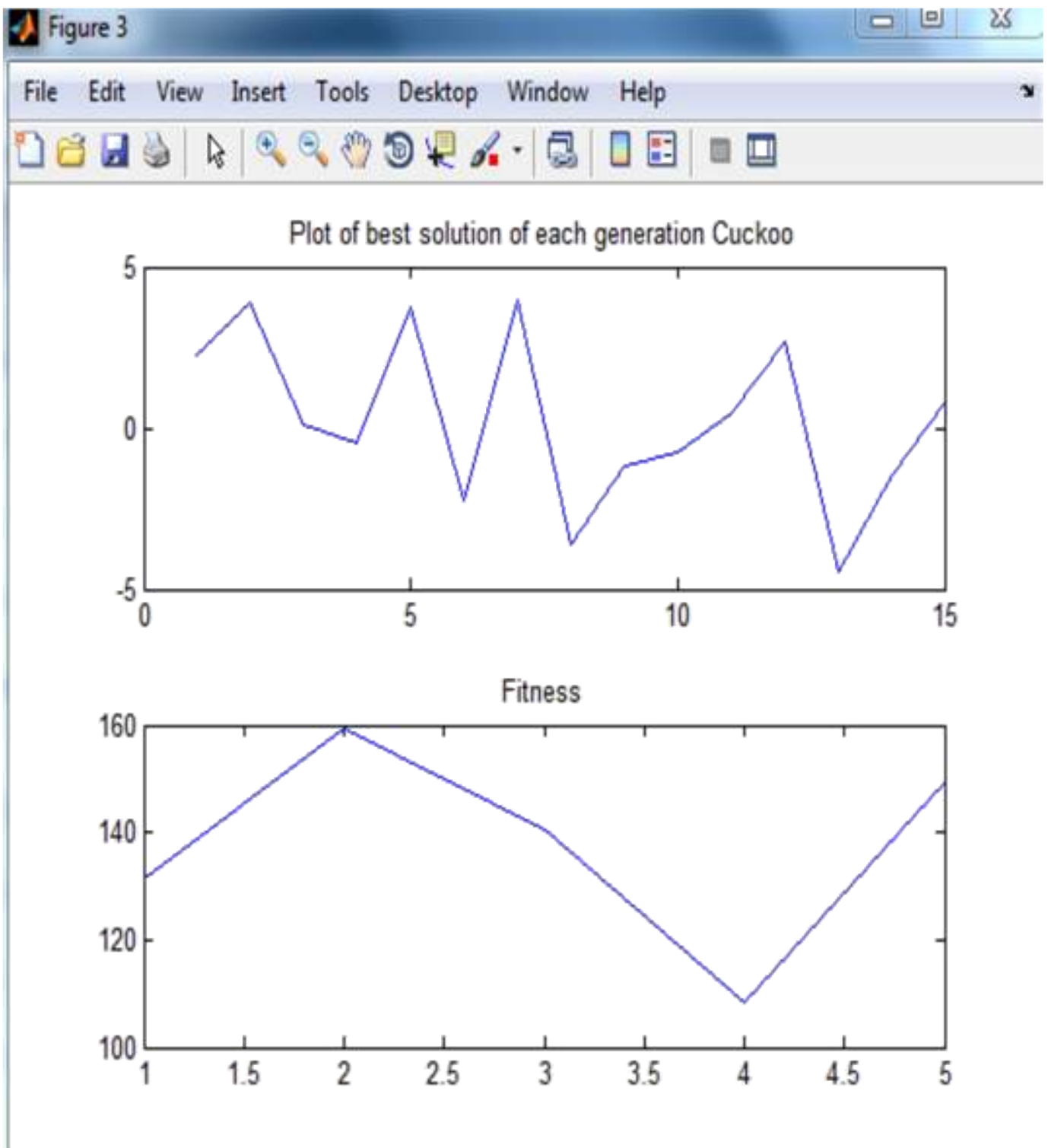
Fig 7.11 best solution of cuckoo search algorithm

Fig 7.12: best solution of cuckoo search

Chapter 8

CONCLUSION:

In this paper we have developed a hybrid procedure that gains the advance of both procedure genetic procedure and cuckoo search procedure. Difficulty of genetic procedure is that it can be simply stuck in confined optima so to remove this difficulty we are using cuckoo search procedure along with genetic procedure. We will apply genetic procedure and suggested hybrid procedure for tasks scheduling. We will compare result of both procedure genetic procedure and hybrid procedure for job scheduling and performance of hybrid procedure should be better than genetic procedure. In this paper we have suggested a hybrid procedure that combines the gain of both genetic procedure and cuckoo search procedure and it should provide the healthier result as match with genetic procedure.

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Progeny organism birdies- Clutch organism birds do not make their own nest. These birds lay eggs in other bird's nest. Ex- Cuckoo.

Combinatorial Difficulty- A combinatorial difficulty is comes under problems for which an optimum organization and choice of choices is desired.

NP- Complete Problem-Np type of problems are those problems for which solution exist but there is uncertainty in verifying solution. In these kinds of problem polynomial time rises as scope of problems rises.

Metaheuristic algorithms- These methods are based on natural processing. These types of approaches are problem liberated method that can be useful for a large variety of difficulties.

Local Search- Confined quest is a metaheuristic process to resolve NP difficulties. It transfers from one result to a new in the quest space checkout the period an best result is not originate or period is not ended.

B-

Brood parasite birds

C-

Combinatorial problem

Continuous optimization problem

Convergence rate

Cuckoo Search (CS)

Crossover operator

Chromosome

D-

Discrete optimization problem

E-

Edge

Egg laying region

F-

Foraging behaviour

Fitness function

Fitness value

G-

Genetic algorithm

H-

Habitat

Heuristic

Hybrid

L-

Local Search

M-

Metaheuristic algorithms

Mutation operator

N-

Node

NP- Complete Problem

O-

Optimization Algorithm

Population

Probability function

One point crossover

S-

Selection operator

T-

Two point crossover