SOLVING BI-OBJECTIVE 4-DIMENSIONAL TRANSPORTATION PROBLEM BY USING PSO

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ABSTRACT : *In this research to build mathematical models for a new Bi –objective 4-dimensional transportation problem view of the complexity of these models were used in a new way to decoding procedure for the mathematical models by creating encryption for these special models transport has been generating a set of Bi –objective 4-dimensional transportation problem of a first mathematical model to the of transportation problem and solved using Particle swarm optimization (PSO) algorithm and compared with the genetic algorithm(GA) which proved PSO efficient algorithm to find good solutions in a timely manner*

Keywords: Transportation problem**,** 4-dim model**,** Bi –objective problem, Evolutionary Algorithms(EA), Particle swarm optimization (PSO)**,** genetic algorithm (GA)**,** Decoding procedure.

1. INTRODUCTION:

Concerned with transport problems on the whole distribution of products or certain goods from sources (Sources) to sites or places of unintended (Destinations) so that the total time or the total cost of the transport of The least we can .the transport model one linear programming techniques that have emerged because they grow in the context of finding a shipping plan (transport) optimal.

We need to solve the transportation dilemma to data on the quantities available of the required material shipped each source (warehouses, factories ...... etc) requests or requirements by locations (places intended) requesting these quantities. We also need to know the cost of transport per unit of each source to every destination location (site) in the event that our goal is to reduce overall transportation costs if either objective of the study is to reduce the total time of the transport we need to know the time required to transport per unit of each source to each site on the condition to be transported units and quantities required homogeneous ie only one type, as well as the transport operations, be by moving from one type of homogenous .the all relationships in this matter in writing and there are many multiple ways to resolve the dilemmas of transport, but the simplex method (Simplex) considered effective method in such problems.

The researcher (Frank L.Hitchcock) (1) first from standard format to the problem of transport mode in 1941 and considered the foundation adopted (Dantzig) to build your style in a way simplex (Simple method) 0 In 1947, interest (Koopmans) the possibility of the use of linear programming model in solving transport problems, as a result of the efforts exerted by (Hitchcock) and (Koopmans) in the development of transport models so called transport problems in some cases, their names (Hitchcock-Koopmans problems) .

The transportation model for researchers (Hitchcock-Koopmans Problems) aims to reduce the total costs (minimize cost) for the transport of amounts of one type of different processing centers (sources) to the various demand centers (Destinations) and limitations is a private center equipped and demand centers of operations

In 1974 (Bhatia) introduce method to solve the problem of transports designed to reduce the time of the transport process (minimize time) for the transport of amounts of one type of different processing centers (sources) to the various demand centers (Destinations) and limitations is a private center, processing centers, and operations the demand.

In 1977, researchers presented (Sharma * Swarup) model to process three-transport-dimensional (3- Dimensions) aims to reduce the time of the transport process (minimize time) for the transport of amounts of one type of different processing centers (sources) to the various demand centers (Destinations) The different modes of transport and its constraints is a special operations processing centers and demand centers and transport restrictions heterogeneous.

2. Transportation problems (2 dim)

This model consists of a reduce the objective function the cost of transportation process quantities of one type of the various processing stations to various demand media centers move from one type:

$\text{Min } Z = \sum_{i}^{m} \sum_{j}^{n} C_{i,j} X_{i,j}$

S.to: $\sum_{j=1}^{n} X_{i,j} = a_i$, $i = 1,2, \ldots m$ (supply)

$\sum_{i=1}^{m} X_{i,j} = b_i \quad j = 1,2, \ldots . n(\text{demand}) \qquad X_{i,j} \geq 0$

Where

a_i: The total supply of the product from warehouse i

b_i:The total demand for the product at outlet j

$C_{i,j}$:The cost of sending one unit of the product from warehouses i to outlet j.

$X_{i,j}$= the sizes of the transport from warehouse i to outlet j.

3. The proposed Transportation models(4 dim)

The proposal includes a transportation model on bi-objective the first goal to reduce costs and the second goal reduces the time for transport of the different goods of varieties and different modes of transport to processing centers to demand centers.

Mathematical model (1)

$$Min\ cost\ Z_1 = \sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{k=1}^{p} \sum_{q=1}^{d} C_{i,j,k,q} * X_{i,j,k,q}$$

$$Min\ time\ Z_2 = \sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{k=1}^{p} \sum_{q=1}^{d} T_{i,j,k,q} * X_{i,j,k,q}$$

For the model proposed restrictions are a special operations outsourcing processing and application centers restrictions and limitations of different types of goods transported and limitations of the various modes of transport, which is the transport of goods from the way.

S.to:

$\sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{k=1}^{p} X_{i,j,k,q} = a(q) \quad \forall q = 1, \ldots, d$

$\sum_{j=1}^{n} \sum_{k=1}^{p} \sum_{q=1}^{d} X_{i,j,k,q} = b(i) \quad \forall i = 1, \ldots, m$

$\sum_{i=1}^{m} \sum_{k=1}^{p} \sum_{q=1}^{d} X_{i,j,k,q} = d(j) \quad \forall j = 1, \ldots, n$

$\sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{q=1}^{d} X_{i,j,k,q} = L(k) \quad \forall k = 1,\dots,p$

$X_{i,j,k,q} \geq 0$

Where

$X_{i,j,k,q}$: The amount of goods transported by type (k) of the processing center (i) to demand center (j) means the transport of the type (q).

$C_{i,j,k,q}$: The cost of the transport of one unit of commodity-type (k) of the processing center (i) to demand center (j) means the transport of the type (q).

$T_{i,j,k,q}$: The time of the transport of one unit of commodity-type (k) of the processing center (i) to demand center (j) means the transport of the type (q).

a(q): Quantities of goods available in the processing center q.

b(i): Quantities of goods needed in the demand center i.

L(k): A number of miscellaneous goods in processing center k.

d(j): The maximum q mode of transport used in the transportation process.

m: the number of processing centers.

n: the number of demand centers.

p: the number of types of goods

d: the number of different types and modes of transport.

It is possible to derive a mathematical model for the second four-dimensional problem of the transport by making the right side of the two-dimensional limitations where possible be required amounts or quantities to be processed by species mathematical model shall be as follows:

Mathematical model (2)

$$Min\ cost\ Z_1 = \sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{k=1}^{p} \sum_{q=1}^{d} C_{i,j,k,q} * X_{i,j,k,q}$$

$$Min\ time\ Z_2 = \sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{k=1}^{p} \sum_{q=1}^{d} T_{i,j,k,q} * X_{i,j,k,q}$$

S.to:

$\sum_{i=1}^{m} \sum_{j=1}^{n} X_{i,j,k,q} = a(q,k) \quad \forall q\ 1 \dots d\ \forall k = 1..p$

$\sum_{j=1}^{n} \sum_{q=1}^{d} X_{i,j,k,q} = b(i,k) \quad \forall i 1,\dots,m\ \forall k 1,\dots,p$

$\sum_{i=1}^{m} \sum_{k=1}^{p} \sum_{q=1}^{d} X_{i,j,k,q} = d(j) \quad \forall j = 1..n$

$\sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{q=1}^{d} X_{i,j,k,q} = L(k) \quad \forall k = 1..p$

$X_{i,j,k,q} \geq 0$

$a(q,k)$: Quantities of goods available in the processing center q by genre k.

$b(i,k)$: Quantities of goods needed in the demand centers as i type k.

But if each species to be transported to him certain tanker becomes a mathematical model as follows:

Mathematical model (3)

$$Min\ cost\ Z_1 = \sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{k=1}^{p} \sum_{q=1}^{d} C_{i,j,k,q} * X_{i,j,k,q}$$

$$Min\ time\ Z_2 = \sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{k=1}^{p} \sum_{q=1}^{d} T_{i,j,k,q} * X_{i,j,k,q}$$

$\sum_{i=1}^{m} \sum_{j=1}^{n} X_{i,j,k,q} = a_{q,k} \quad \forall q = 1 \dots d\ \forall k = 1..p$

$\sum_{j=1}^{n} \sum_{q=1}^{d} X_{i,j,k,q} = b_{i,k} \quad \forall i = 1..m \quad \forall k = 1..p$

$\sum_{i=1}^{m} \sum_{q=1}^{d} X_{i,j,k,q} = d_{j,k} \quad \forall j = 1..n$

$\sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{q=1}^{d} X_{i,j,k,q} = L_k \quad \forall k = 1..p$

$X_{i,j,k,q} \geq 0$

$d_{j,k}$: a maximum of a means of transport q used in the transport of type k process.

4. Decoding procedure

It is the effectiveness of the use of algorithms and artificial intelligence in complex and large-scale problems where it is difficult modeling and solving using methods of seized and given the number of variables in the four-dimensional transportation model we will use algorithms and artificial intelligence in solving the specimen but before resolving the specimen has to be to find a decoding procedure helps algorithms artificial intelligence in the search for good solutions in record time and steps decoding procedure used in solving the problem of four-dimensional transportation model are as follows:

Procedure : Decoding
Input
m: Number of Supplier centers.
n: Number of demand centers.
p: Number of Items.
d: Number of vehicles.
a(q):Quantities of Items available in the Supplier centers q
b(i) : demand of items in demand center i.
L(k) : The amount of diverse items in the supplier centers k.
d(j): the capacity of vehicle j.
$C_{i,j,q,k}$ **: Cost of transportation** $\forall q = 1,\dots,m \quad i = 1,\dots,n \quad k = 1,\dots,p \quad j = 1,\dots,d$
$V(i|j|q|k)$ **: particle for transportation**
Output
$x_{i,j,q,k}$ **: The amount transportation.**
Step 1: $x_{i,j,k,q} \leftarrow 0 \ \forall q \in m \quad i \in n \quad k \in p \quad j \in d$
Step 2: $i^* \leftarrow \text{argmin} \{C_{i,j,q,k} | V(i) \neq 0 \quad i \in n\}$ **select a** i **lowest cost**
$j^* \leftarrow \text{argmin} \{C_{i,j,q,k} | V(j) \neq 0 \quad j \in d\}$ **select a** j **lowest cost**
$k^* \leftarrow \text{argmin} \{C_{i,j,q,k} | V(k) \neq 0 \quad k \in p\}$ **select a** k **lowest cost**
$q^* \leftarrow \text{argmin} \{C_{i,j,q,k} | V(q) \neq 0 \quad q \in m\}$ **select a** j **lowest cost**

Step 3: $x_{i^*,j^*,q^*,k^*} \leftarrow min\{a_{q^*}, b_{i^*}, L_{k^*}, d_{j^*}\}$ **update the availabilities**

$a_{q^*}=a_{q^*} - x_{i^*,j^*,q^*,k^*}$ $b_{i^*} = b_{i^*} - x_{i^*,j^*,q^*,k^*}$ $L_{k^*} = L_{k^*} - x_{i^*,j^*,q^*,k^*}$ $d_{j^*}=d_{j^*} - x_{i^*,j^*,q^*,k^*}$

Step 4: if $a_{q^*} = 0$ then $V(i^*|j|q|k) \leftarrow 0$

if $b_{i^*} = 0$ then $V(i|j^*|q|k) \leftarrow 0$

if $L_{k^*} = 0$ then $V(i|j|q^*|k) \leftarrow 0$

if $d_{j^*} = 0$ then $V(i|j|q|k^*) \leftarrow 0$

Step 4 : if $V(i|j|q|k) = 0 \ \forall q \in m \ \ i \in n \ \ k \in p \ \ j \in d$ **then Output** $x_{i,j,q,k}$

Else return step 2

Table follows shows an illustrative example of the work decoding procedure to form four-dimensional transportation model.

Table(1) Decoding Procedure for 4dim transportation m=3 n=2 p=3 d=2

Iteration	**Particle**	A	b	L	d	q^*	i^*	k^*	q^*	$x_{i,j,q,k}$
1	[3 1 2|2 1|3 2 1| 1 2]	(10 15 5)	(20 10)	(10 10 10)	(15 15)	1	1	3	1	10
2	[3 0 2|2 1|0 2 1| 1 2]	(**0** 15 5)	(10 10)	(10 10 0)	(5 15)	2	1	2	1	5
3	[3 0 2|2 1|0 2 1| 0 2]	(**0** 10 5)	(5 10)	(0 5 10)	(0 15)	3	1	2	2	5
4	[0 0 2|2 0|0 0 1| 0 2]	(**0** 10 0)	(0 10)	(0 0 10)	(0 10)	2	2	1	2	10
5	[0 0 0|0 0|0 0 0| 0 0]	(**0** 0 0)	(0 0)	(0 0 0)	(0 0)					

5. Evolutionary Algorithms (EA)

Which it is about methods (Random Search) inspired by nature and that mimic natural biological evolution or social behavior of the species, which is a different calculation system looking for a quick and robust solution to complex Optimization problem The most important of these methods are Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Ant Colony Optimization (ACO), Simulated Annealing (SA).

Overall Evolutionary Algorithms differ from traditional search methods and Optimization techniques as the most important differences are:

- Evolutionary Algorithms looking at the points of a society in parallel rather than in a single point.
- Evolutionary Algorithms using rules to move probabilistic rather than deterministic.
- Evolutionary Algorithms are usually more pronounced for the application, the lack of restrictions to define the objective function.
- Evolutionary Algorithms do not require derivative information or other knowledge to help but require objective function and levels of fitness that affect directly to paralyze the research process.
- Evolutionary Algorithms used to accelerate the solution of complex mathematical models by moving to areas more likely to find a solution does not pass in all the important points of the solution or is the task sequentially as applicable in the traditional ways of solution.

5.1 Genetic algorithm (GA)

It is considered a genetic algorithm is one of the algorithms public searches based on natural selection and the system of natural gene mechanism, developed by the world's John Holland in 1970 Michigan University, as it was the primary goal of which build and improve many of the algorithms publication of numerous research in this area software and systems using this algorithm, and in 1975 he applied to the solve Combinatorial Optimization Problems, then in 1987 he studied Davis effect of using different types of overlap substitution, mutation and encryption methods to implement and the results of a genetic algorithm, Goldberg also has applied genetic algorithm on some of the fitness problems in his book, which was published in 1989, where he addressed where these problems and how to solve them by using this algorithm.

The genetic algorithm includes a number of basic steps, these steps are interconnected with each other, nor can this algorithm applied to any matter what not all these steps apply only to lose and a genetic algorithm value and usefulness in creating or improving the solution of the problem to be solved.

5.1.1 Selection

A choice of the parents in the community for mating and production of a new generation process this process and play an important role in the development of a genetic algorithm, through the selection of the best members of society.

And methods of selection of the roulette wheel of this method depends on the choice of the best of the community members, after calculating the Total quality of society and the expense of the quality of each individual in relation to the total, and use the resulting values the possibility to choose individuals in subsequent generations.

5.1.2 Crossover

This process is to make the switch between the values of the opposite section of parents elected for the purpose of formation of the new section. The exchange between the two sections sites specify either randomly, or depending on the method of proportional representation section with the formula and on the privacy problem to be applied. It is likely to give the new section a better solution than the sections that are such solutions there are several formulas for process overlap substitution .following shows the crossover process.

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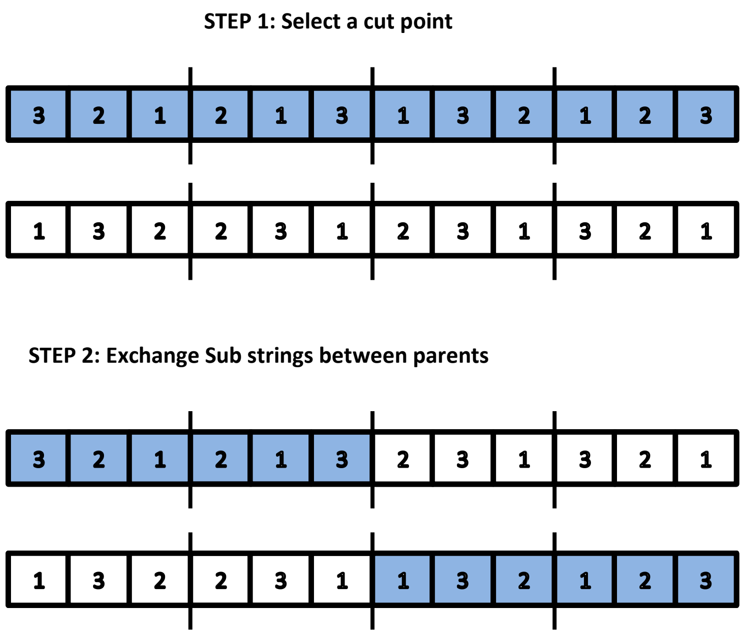
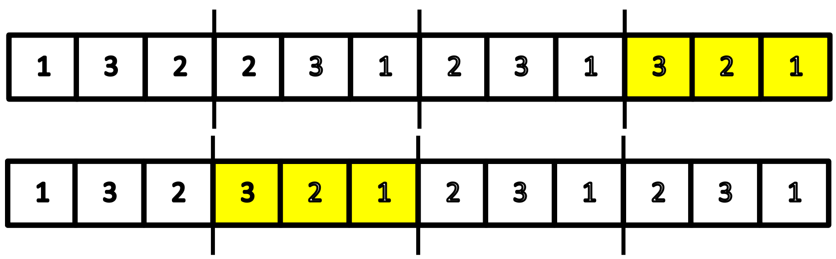


Fig (1). Illustration of the Crossover for 4dim Transportation problem.

1) Mutation for equal sub



2) Mutation in sub string

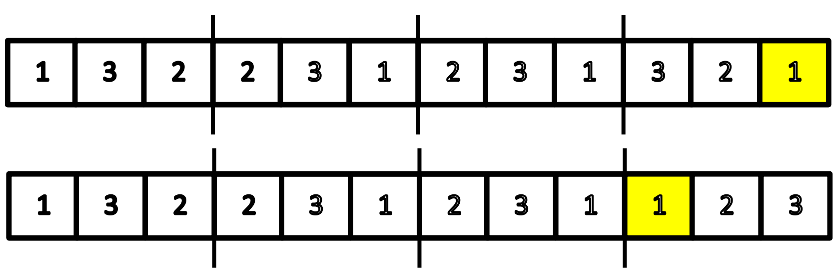


Fig. (1). mutation for 4dim Transportation problem.

rocedure : GA for 4dim transportation Problem
Input
m: Number of Supplier centers.
n: Number of demand centers.
p: Number of Items.

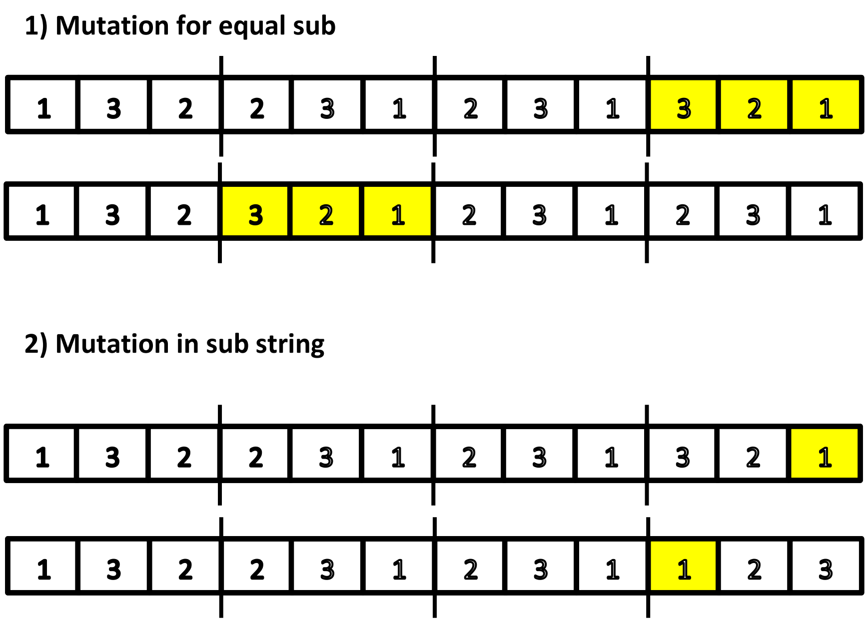


Fig.(2).Mutation for 4dim Transportation problem.

d: Number of the vehicle.
a(q):Quantities of Items available in the Supplier centers q.
b(i) : demand of items in demand center i.
L(k) : The amount of diverse items in the supplier centers k.
d(j): the capacity of vehicle j.
$C_{i,j,q,k}$: Cost of transportation $\forall q = 1, \dots, m \quad i = 1, \dots, n \quad k = 1, \dots, p \quad j = 1, \dots, d$
Output
$V(i|j|q|k)$: best individual's for 4 transportation
STEP 1:
1) choose initial population
2) insert individual's in decoding Procedure
3) evaluate each individual's fitness
4) determine population's average fitness
repeat
STEP 2: Do
select best-ranking individuals to reproduce
1) mate pairs at random
2) apply crossover operator
3) apply mutation operator
4) evaluate each individual's fitness
5) determine population's average fitness
End
until terminating condition (e.g. until at least one individual has the desired fitness or enough generations have passed)

5.1.4 Mutation

In this process, it is changed or switch between specific genes within a single chromosome to form chromosomes give new solutions to the next generation, which has never configured in previous generations in order to expand the best possible

5.2 solution and the composition of a larger number of different chromosomes within a generation. This configuration leads to getting more closer to the optimal solution. In this paper, we will first conduct two types of mutation be among the parts of the second section and be within every part of the section

5.3 Particle Swarm Optimization

It is the particle swarm optimization algorithm of important developmental algorithms and returns to class intelligent Squadron used in solving the problems of optimization techniques as it has been drafting these algorithms by Edward and Kennedy in 1995.

The swarm is a set of particles, which represent a range of solutions, called a particle, and if what has been subject to link the social life of the birds, the word particle shows a flock of birds, the word particle indicates a bird in a flock of particles. Therefore, the idea of this algorithm has been inspired by the behavior of a swarm of particles as it simulates the behavior of this particle swarm .each particle in the squadron by acting in a special way by relying on his intelligence, collective intelligence of a group swarm.

As part of multiple variables Optimization, it is assumed that the particles have a specific fixed size, taking into account that each particle is supposed to be two features which are: the location and Velocity are available, and each particle wandering in the allotted space, taking into account the best site to him in terms of food or finding the best value the objective function. Also, the particles of information or good sites to each other and adjust their positions and Velocity based on the information received from the new sites.

Has been developed PSO based on the model follows:

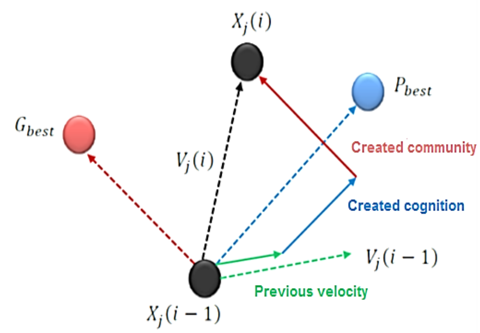
- When the particle found on the target (the food), it shall promptly transmit information to all other particles.
- All other particles are attracted towards the goal, but not directly.
- Independent thinking of each particle from the rest of the flock particles and the memory of the past.

Thus, the model simulates random search in the designer space to get the best (greater or smaller) the value of the objective function, as this gradually and many duplicates particles move to the goal.

PSO used to resolve complex problems and partly irregular problems and problems change with the passage of time because of the characteristics carried by the algorithm, and of the Velocity of implementation and efficiency of high performance.

5.3.1 Steps of particle swarm optimization algorithm

1. Suppose that the size of the squadron (the number of particles in the squadron) has the symbol N, and the size of the flock is usually between 20 and 30 graves as a centrist.
2. Generate primary society (X) randomly such as$(X1, X2, \dots, XN)$, then for the purpose of convenience, the grave site j and Velocity in the iteration i represent $Xj\ (i)$ and Vj (i) respectively, and so the particles generated in the beginning symbolizes his $X1\ (0), X2\ (0), \dots XN\ (0)$, if the vector $j = (1,2, \dots N), Xj(i)$ called particle or vector coordinates of the particles, then the target function values are calculated corresponding to the particles.
3. find velocities of the particles, if the particles are all moving to the optimum Velocity using point and, initially, be accelerated all-zero particles, put abacus iteration i = 1.
4. In iteration i, we find the following two parameters used by particle j:
   - A better local site of the particle.
   - Find the Velocity of the particle j in the iteration i and as follows:



$$Vj(i) = Vj(i+1) + c1r1[Pbest, j - Xj(i-1)] + c2r2[Gbest - Xj(i-1)],$$
$$j = 1,2, \dots., N \quad (\ )$$

As the V represents the Velocity of the particle, C1, C2 acceleration transactions usually were taking the value (2), r1, r2 represents random numbers fall within the domain (0,1), Pbest represent the best position for the current particle of the squadron, Gbest represent the best position of the particle within the whole flock.

- Identify the location or the coordinate of the particle j in the iteration i and as follows:

$Xj(i) = Xj(i-1) + Vj(i), j = 1,2, \dots, N$ •

After that is a function calculating the corresponding goal of the particles.

5. Is checked convergence current solution, if the sites particles are all close to the same group values, it means for rapprochement, but if not achieved the standard convergence returned Step 4, after renovation abacus frequencies to be $i = i + 1$, and calculate new values to each of the Pbest, Gbest . Iterative process continues until all the particles closer to the ideal solution itself .

5.3.2 Components of the Velocity equation in PSO

An equation to determine the velocity of the three borders composed, as follows:

- Previous velocity $V_j\ (i-1)$: represent direct previous movement and used as a memory to the direction of flight, this limit is explained as a torque prevents particle to change direction abruptly, and this makes the particle is biased more to the previous trend.
- Cognition Created $c1r1\ [Pbest, j - Xj\ (i-1)]$: tracks the performance of the particle j relative to past performance, mean-

ing that cognitive component is similar to an individual memory location of choice for serious, this reduction affects the particle drift toward the best-ever site, similar tendencies Return to the serious situation or the best place in the past.

Community Created $c2r2\ [Gbest - Xj\ (i-1)]$: It tracks the performance of the particle j for the sum of neighboring particles, and the idea of the community component of the similarity of the standard group you are looking for the squadron particles and is seeking to be Thakagaha.an society Created in deviation of each particle toward a better site found among the vicinity of the particle effect. And shape () shows the effect of speed on the components of the new location of the particle.

6. Numerical Example

To the idea of situating the 4-dim transportation problem, we will give four-dim transportation with bi-objective.

And then to resolve this problem using the PSO algorithm based on decoding procure in decoding particles blades for PSO algorithm and table follows shows the details of the matter and also to resolve the matter and the values of objective functions.

Procedure : PSO for 4dim transportation Problem

Input

m: Number of Supplier centers.

n: Number of demand centers.

p: Number of Items.

d: Number of vehicles.

a(q):Quantities of Items available in the Supplier centers q

b(i) : demand of items in demand center i.

L(k) : The amount of diverse items in the supplier centers k.

d(j): the capacity of vehicle j.

$C_{i,j,q,k}$**: Cost of transportation** $\forall q = 1,\dots,m \quad i = 1,\dots,n \quad k = 1,\dots,p \quad j = 1,\dots,d$

Output

$V(i|j|q|k)$ **: best particle for 4 transportation**

STEP 1: For each particle:

Initialize particle

STEP 2: Do:

a) For each particle:

1) insert particle in decoding Procedure

2) Calculate fitness value

3) If the fitness value is better than the best fitness value (pBest) in history

4) Set current value as the new pBest

End

b) For each particle:

1) Find in the particle neighborhood, the particle with the best fitness

2) Calculate particle velocity according to the velocity

3) Apply the velocity constriction

4) Update particle position according to the position

5) Apply the position constriction

End

While maximum iterations or minimum error criteria is not attained

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Table(2) the data for bi objective 4-dim transportation problem

$$a_1 = 37 \quad a_2 = 50 \quad b_1 = 43 \quad b_2 = 44 \quad d_1 = 41 \quad d_2 = 46 \quad L_1 = 55 \quad L_2 = 32$$

k=1 q=1

i \ j	1	2
1	(8,49)	(9,35)
2	(9,23)	(8,44)

k=2 q=1

i \ j	1	2
1	(5,39)	(7,48)
2	(9,32)	(5,28)

k=1 q=2

i \ j	1	2
1	(8,23)	(4,42)
2	(6,20)	(8,47)

k=2 q=2

i \ j	1	2
1	(7,26)	(8,45)
2	(3,23)	(4,22)

And after the solution of the problem using the PSO the results were as follows**:**

Table(3) result in bi objective 4-dim transportation problem using PSO

k=1 q=1

i \ j	1	2
1	0	14
2	0	0

k=2 q=1

i \ j	1	2
1	0	0
2	0	23

k=1 q=2

i \ j	1	2
1	29	0
2	0	0

k=2 q=2

i \ j	1	2
1	12	0
2	0	9

Where the value for objective function is $f_1 = 593 \quad f_2 = 2311$

7. EXPERIMENTAL RESULTS

To test the efficiency of PSO algorithm has been generating a total of numerical problem 4-dim transportation problem by randomly generated as a setting correct and then solved using the PSO algorithm, GA algorithms were programmed in the programming language **MATLAB 2013 b** has been implemented on the calculator specifications windows 7 Ultimate, Cpu core i5, Ram 4 G.B table follow his been result:

Table(4) the result of comparison between PSO AND GA

instance	size	N.Varible	PSO			GA		
			F1	F2	T(s)	F1	F2	T(s)
1	$5 \times 2 \times 3 \times 3$	90	**453**	**2424**	**6.80**	**658.09**	**3635.**	**34.00**
2	$8 \times 4 \times 5 \times 6$	960	**624.3395**	**4195.361**	**241.7703**	**1172.616**	**7075.891**	**1208.852**
3	$9 \times 6 \times 9 \times 9$	7776	**4878.5**	**2.65E+04**	**132.6009**	**8519.141**	**42477.29**	**663.0043**
4	$10 \times 8 \times 9 \times 8$	5760	**13087.5**	**4.82E+04**	**1.43E+02**	**12305.38**	**80912.13**	**7.14E+02**
5	$12 \times 10 \times 9 \times 10$	10800	**15243**	**7.68E+04**	**1.61E+02**	**20972.13**	**115767.1**	**8.03E+02**
6	$15 \times 12 \times 9 \times 12$	19440	**26740**	**1.01E+05**	**1.87E+02**	**30317.97**	**161645.8**	**9.36E+02**
7	$20 \times 14 \times 10 \times 14$	39200	**26663**	**1.33E+05**	**3.15E+02**	**35222.37**	**195952.7**	**1.58E+03**
8	$22 \times 14 \times 12 \times 15$	55440	**29029.33**	**1.62E+05**	**6.90E+02**	**37946.37**	**252802.1**	**3.45E+03**
9	$24 \times 18 \times 12 \times 16$	82944	**34581.75**	**1.83E+05**	**8.10E+02**	**48650.92**	**275101.6**	**4.05E+03**
10	$25 \times 20 \times 12 \times 20$	120000	**38098**	**216873**	**9.36E+02**	**59242.25**	**299459.2**	**4.68E+03**

8. CONCLUSIONS

1. The decoding procedure helped in guiding the search for algorithms for good solutions to the specimen as such models contain a huge range of variables and the use of Decoding procedure helps reduce search time and get good solutions in a timely manner.
2. Gave the model four-dimensional flexibility to model the transportation and apply the practical reality that the majority of the transport processes are the different types of products different modes of transport from different sources to a certain request processing sites.
3. It demonstrated the importance of the use of artificial intelligence algorithms to resolve the multiple objective 4-dim models that are in abundance variables and restrictions process as set out in the table().
4. It proved the comparison between GA and PSO algorithm efficiency particle swarm to reach efficient solutions in good time.

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