MANAGING SYSTEM OF URBAN SOLID WASTE USING MULTI-CRITERIA DECISION-MAKING METHODS

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Abstract: this article contains two parts. In the first part, in a brief introduction of single parametric programming and its solving ways, the weak and strong points of this method is exposure. Because of constraints of putting whole objectives in parametric programming and not finding all optimum parametrical points, the multi-objective programming (multi-criteria decision making) is exposure. After introducing, the solution ways and related algorithms which are introduced in brief and in the second part, managing system of solid waste of city and one of its usages with its model is given. In this part with introducing machinery and process of system and urban divisions using Integer programming, the division algorithm is exposure and according to this points model and its solution way is introduced.

INTRODUCTION: multi-criteria programming matters talk out from 1970 and have had much efficiency. Parito, economist and sociologist (French & Italian) founded the optimality concept in economy area according to this aims. Because of too many agreements and disagreements in constant economy and social life, the efficient point set named Parito and the main application of multi-criteria programming is:
Manufacturing machines - oil refining times - production designing – budgeting -forests management - transportation - priorities of civil projects - optimum specification of fire-fighting services and managing system of solid urban waste products … which preparing models and solution ways are exposure after introducing multi-criteria programming.

1. Multi-criteria decision-making

multi-objective programming based on single – criteria programming. In single – purpose programming the model is consists of goal function of maximizing or minimizing and a set of equations of constraint and conditions of the problem. For being more familiar firstly attending to the single – criteria programming as a bridge between single & multi – criteria is useful. Consider following problem.

$$Max\,\{c'x = z\}$$
$$\text{S.T}$$
$$x \in s$$

C^1 single row vector transpose is one of goal function factors. In mathematical programming it is very important to analyze the sensibility of subjects. The alternatives of the problem are given from analyzing of sensibility and it makes the determiner make satisfactory decisions in various conditions. One of the states of sensibility analyzing is changing of c^1 vector and we consider $C^2 \in R^n$ as alteration vector and $C^+ \in R^n$ as Gradient of the parametric goal function. In use methods of parametric goal programming convex combination, criteria cone, the view of multi – criteria programming to parameterize the goal function. To explain the subject and get the result, we merely explain this method.

The Gradient of goal function is $C^{+} = C^{1} + \phi C^{2}$ that $\phi \in [0 , \phi_{max}]$ is a positive scalar and ϕ_{max} is a constant amount. In this method when ϕ increases from zero to ϕ_{max} traverse the ways from extreme points which optimize the problem parametrically.

***Definition*:** $\bar{x} \in s$ is a parametric optimum if $\bar{x}$ for some ϕ from $[0, \phi_{max}]$ increase the $Max\{\bar{c}x \,|x \in s\}$ to the highest quantity.
Of course, parametrical programming of criteria cone (two dimensions) is the best explanation of view points limitations and opinions and interests about the multi-criteria subjects.
However, the problem of all this methods is they cannot find all the parametric optimum points. Actually, a non-circular way from points and top part of extreme which one of generators of criteria cone makes it Maximum connects it to another extreme point, which maximize from another generator.
With increasing various parameters, some new goal functions add to the model and throughout multi-objective programming, it should simulate and solve. With solution ways of multi-objective programming, we can find all the parametric optimum points.

Definition: suppose $V \subset R^{n}$ a closed convex cone. Then we name $\bar{x} \in s$, weak efficient point, if and if for some c^{+}s (related to v), $\bar{x}$ point solve the $Max\{c^{+}x \,|x \in s\}$
(it means c^{+} is a point from convex combinations of v producers.)
We have so many ways to solve which one of solution ways is maximum vector. In this state v is a closed convex two directional cone, and set of all weak points of the some set, are just all parametric points. So from the algorithm of maximum vector, which is to find all parametric optimum points, an LP problem of parametric objective function is used.
Therefore, to solve an LP parametric goal function problem, it should be built a MOLP in the following form

$$Max\{c^{1}x = z_{1}\}$$
$$Max\{c^{2}x = z_{2}\}$$
$$\text{S.T}$$
$$x \in s$$

That c^{1} & c^{2} are the generators of two dimensional criteria cone.
If this method has been used, all the parametric optimum extreme points are resulted but with using current methods of parametric objective function, some of optimum extreme points are gotten. Which the election again gets optimum.
Therefore, in LP single goal problems, we have one-directional cones and in LP parametrical two directional problems in MOLP, we have multi-direction cones.
There are certain objectives and constraint in countering the objective problems. Not all objectives can be optimized at best circumstances because the system has large number of communications. Objectives are separate from each other and cannot be mixed and aggregated. It is possible that improving one requires heavy costs to be laid on other. As a result, we are compelled to obtain a problem model having one general objective in the form of multi-objective programming implications.
The optimal solution can be given with a satisfactory one. It can be sought in an extensive way by using region's Alternatives. Interactive methods are specified and followed by varied decision making and concerned calculations. In a general mode, a continuously repetitive lay upend pattern can be set-up by the conclusion of Algorithm. An each time of repetition, a solution or a group of solutions can be obtained in the solution problem. This decision making process enables the decision maker to evaluate all capabilities in the region as well as evaluate recuperative effects and criterion by using trade off exhibit. Decision maker determines that the best solution can be sought where he wants, How to search for a final solution. Interactive

approaches authorize the effective division of operations and allows computer to improve the way in which the data processes implemented and algorithm to be completed. It also permits decision-maker to do it as best as possible by employing the most recent data. Interactive methodologies are of three kinds:

1.1 Method to decrease the possible zone and its Algorithms.

Stem Algorithms: this Algorithm was introduced to solve problems MOLP through the media of Benayoun Motgolfier, Tergny and Laritchev in 1971. In this trend, all objectives are bounded on sets of constraint stranded spaces. Only one new point is gained from all assortments of jobs in every method. Considering the fact that this trend is the first Algorithm and has great effects on multi-criteria programming, it is also applied to the programming implications whether they, are proper or no linear.

1.2 Methods of decrease weighted vector space and its algorithms.

a) Chebishof interactive method

In this method, there is no need to have a objective function linearity and convexity of feasible region. This method differs from maximized vector approach in one way and that is the fact that a metric definition of Chebishof was used for**.**

$$\bar{\Lambda} = \left\{ \lambda \in R^k \,\middle|\, \lambda_i \geq 0, \sum_{i=1}^{k} \lambda_i = 1 \right\} \quad \text{From} \quad \Lambda = \left\{ \lambda \in R^k \,\middle|\, \lambda_i \geq 0, \sum_{i=1}^{k} \lambda_i = 1 \right\}$$

Meanwhile this method acts in a stable number of action frequency. At each time of repetition, a number of static responses are displayed.

b) Z-W Algorithm (Z-W stands for Zionts Wallenius)

This approach was introduced in 1973 by Zionts and Wallenious. in 1983, it was updated. In this method there need to normalized the objective function components. Trend concerning the neighborhood points of Extreme and Trade-off vectors acts based on quarries from the user and their repetitions and eliminates portion of vector space depending on the response to that portion.

Consider the time of replacement of feasible regions by asking user and their frequencies and it elides part of symmetrical vector space**.**

$$\Lambda = \left\{ \lambda \in R^k \,\middle|\, \lambda_i \geq 0, \sum_{i=1}^{k} \lambda_i = 1 \right\}$$

Process ranger from the transformation time of feasible region zone to an eight very small one and finding a final response goes on.

1.3 Criteria conical condensation methods or linear searching methods and their algorithms.

a) GDF Algorithm.

The above-mentioned scientists in 1973.Linear constraint introduced this trend and feasible regions and possibly stranded region are other there. This algorithm uses gradient domination of Franck and Wold due to speedy initial convergence and its simplicity. This Algorithm has:

1. Desirability utility function is a part of tested mathematical function.
2. Each repetition produces a solution.
3. It applies to a mode showing the feasible region is non- linear.

b) Algorithm of interval criteria weights.

This algorithm was innovated in 1977 by STEUER. The aim of this approach is to locate the point locality of efficient extreme with the most quantity of desirability function. In this

approach, a group of non domination vectors is rendered for decision making so that decision maker would be able to specify the criterion with the maximum preference.
As was already pointed out one most noticeable programmer's applications of multi-criteria programming is modeling and solving f management system model of expletive solid. Substances and waste in the cities. We can always take good decision by using properly scientific data; exact and precise programming or planning and employing the experiences acquired and improves them by checking the feedbacks and by reviewing in parameters.

2. Recognition of the present situation and problem definition

We need following data to make models and solving the problems, these one: collection cycle, zoning method possibilities and personnel, available technologies, user systems, system's weaknesses and strengths-statistics and concerned data offering to expletives producer and expletive tonnage.
Of course, it deserves to be kept saying that if the problems of the above-mentioned services problems should not be solved in larger cities, a grave implication would arise for a city. In spite of the fact that the manner in which solid wastes are recovered can be disputed, however, the aim behind this paper is to introduce an optimum method for management system. In General and roughly speaking, waste or surplus substances in cities are classified into three categories:
1) Home wastes 2) Industrial wastes and 3) Hospital ones.
Over a few years ago, Even in capital cities (metro politeness, all produces were moved to sanitary landfills which were thoroughly unhealthy. Luckily, some reformed were undertaken in this case.
Following measures should be taken to solve scientific and principal problems. Waste disposals are treated in four following manners:
1) Sanitary landfill 2) Burning 3) compost 4) Recycling

2.1 Sanitary landfill

Following points must be noted in determining the number and location of waste burial disposal: Location, topology, ground water level, monsoon wind, data concerning watercourses, easy access to sanitary landfills, urban contingent development and charges diminution such as disadvantages and model aims.

2.2 Burning

This method is applied to a sort of waste that can be burned up and to be incinerated by central or local oven. This problem ensues consequences, which must be considered while taking the aims and scopes under consideration. It is conclusively an advantageous at a time when a land can be found easily for the disposal of solids.

2.3 Compost

In this method, the organic substances of wastes and remains of foodstuffs are disintegrated into soil-like matters called compost under the action of aerobic microorganisms. The disadvantages of both of them must be best regarded in the model. They are very useful to fertilize the farmlands and accrue grain revenue to producers.

2.4 Recycling

This method is universally applied because most packaged substances are retransformed into their original forms and are thus used in the same way.
Recycling substances are paper, cardboard, plastic, types of metals, glass and car types and… which are segmented by conventional methods and by using of segmentation technology. This segmentation brings forth economic benefits ever and above their benefit of weight and

volume loss. As an example, grain profits accrue to recoveries by recovering steel and fibers inside he car tires. The recovered steel and fibers are expensive in their turn. Tire is milled and hence is used with reacted chemical substances to make coast guard across the seacoast and ports and children playing ground. Of course there are varied and various technologies in the world the discussion of which is beyond the scope of this paper. As an example using of recycled used tires in the grand of buildings foundation enable construction against earthquakes .

Every city, depending on its situations (demographic condition, suburban context, urban wideness, people standard of living and etc, can be subdivided into areas and in every area one or more mentioned technologies are set-up. to facilitate writing the acronyms USWMS in place of expletives management system of urban solid wastes.

USWMS system designing is inherently complex. Because of varied problems associated to each other and it is often very difficult to reach these contradicting aims. The most strenuous problem is that of evaluating the different alternative in management and designing. Use of a mathematic model as a tool for anatomizing and assessing USWMS can, therefore, be useful in different modes. Regarding the ever-increasing expansion of cities, a USWMS process can be categorized into four stages.

Stage 1: Collection of wastes from production place (lines)
Stage 2: Transportation to consumption systems.
Stage 3: process
Stage 4: consumption

Waste disposal from production tine to that of consumers is done in two phases:

Direct phase: In this step of the overall phase, the waste is transported directly from production tine to processors and hygienic sanitary landfills.

Indirect phase: waste disposals are transported from processing systems locations to that of consumption. Let us put for the zoning discussion before entering the model data.

2.5 Zoning model by using integer programming method

Partition method of an assortment method can be used for zoning. Larger cities are configured as fellow in view of their constituencies.

Block: enclosed surface of some interconnected channels or passages are called block.

District : refers to a series of some blocks, which have common specifications and are united together because of physical factors.

Group: some territories alongside each other can form a group with a view to physical factors the said data are ratable in most cities.

If $q_1, q_2 \ldots, q_m$ are called demographic units of each territory and if k is a required section,

$$\bar{q} = \frac{1}{k}\sum^{m} q_i$$

is the average population of any sector, of course neighborhood, density, surface area, topographic location of groups in areas division should be included.

Suppose that n part existing a city which is true to all what was said above and the population of any part equals to p_j, n,…,n,1,2 = j and now let us define aij as follows

$$a_{ij} = \begin{cases} 1 & \text{If unit i exists in division j} \\ 0 & \text{Other cases} \end{cases}$$

In addition, to some extent C_j can be defined as below.

$$C_j = \left| P_j - \bar{q} \right| \quad j=1, 2,\ldots,n$$

In fact this amount indicates the demographic distinction between existing division or constituencies and the required divisions, we can, thus, specify the problem variables as follows:

$$x_j = \begin{cases} 1 & \text{If j section is selected} \\ 0 & \text{Other items} \end{cases}$$

The aim is to obtain an acceptable division, which may be explained as below.

$$Min\, Max \sum_{j=1}^{n} C_j X_j$$

S.T

$$\sum_{j=1}^{n} a_{ij} x_j = 1 \qquad i = 1, 2, \ldots, m \quad \text{indivisible constraint of units}$$

$$\sum_{j=1}^{n} x_j = k \qquad \text{constraint of a number of divisions}$$

Precisely k needed and this is referred to as an NLP (nonlinear integer planning) and can be easily transmuted into an LP problem by applying addition index in objective function, this model can be best applied as problem application.

2.6 Hypothesis and objectives

considering the above mentioned explanations, the following objectives can be considered for the dilemma.

1. First objective function (economic costs): includes investment account of process sets, managerial costs of process sets and sanitary landfills transportation costs.
2. Second objective function (resources wastes): this indicates a quantity of wastes which are eventually transferred to sanitary landfills. By minimizing this standard, the rate of investment in increased. In this model, the amount of waste is considered which can be recovered or transformed into composts in the event the amount of land filled waste in a burial state is increased, we must recede the investment rate in compost so it is obviously necessary that to regard this criteria as an independent one.
3. Third objective function (environmental effects) this tries to specify the perimeter effects of consumer systems in such a way to feel easy and assured to compare are determine the measuring indexes for inhomogeneous factors such air pollution, water pollution, impoverishment of soil.

The factors of environmental effects for the most part depends on physical features and area or regions, technology and capacity of process sets we can calculate a measuring index for any set and location by using these factors. This rate of comparison enables the different solutions could be gained and have no absolute or abstract meaning for convenience, the unit of this quantity can be mentioned as au ecological unit in objective function.

2.7 Hypotheses and constraints

Having completed urban division and ascertaining the areas and regions, demographic parameters average generated waster of every area, areas spaced from each other, cost of transportation of any unit, congestion and etc. can be determined. In addition, limited application for every area, maximum capacity of process system and healthy sanitary landfill and processing sets will be determined in the regions.

We consider the following data:

1. Not more than one single processing system is required in every region.
2. All applications should be satisfied. Each area with definite number of service applications must send them to bury and dispose of wastes.
3. Processing systems have limited capacity.
4. Healthy sanitary landfill must be selected in terms of environment and processing systems can be located alongside of them. The existence of sanitary landfill contributes to the location of processing systems.
5. Transportation from one area to a very remote one is not authorized because too many costs should be incurred for this area.
6. We consider one more supposition to the efficiency
   Arranged by hierarchy' that is to say, transportation is done in two stages.
   a) From area to sanitary landfills and disposal systems.
   b) From disposal systems to sanitary landfills locations.
7. The average lifecycle of sanitary landfill should be less than that of disposal system and after full capacity of sanitary landfills decision maker must be identify new location of sanitary landfills. After identifying the number of zones must be identify location of processing plant by using above algorithms.

Symbols

We use algorithm results of urban division and constituencies to adjust the model, the thing that was explained in pervious part. considered each area as one single node in the network. We represent the all regions with N. Emblems, symbols and in dices to be used for setting up the model are;

{Total urban divisions}= Number of $n = |N|$

i = 1, 2,…, n sets specify any of the regions with i index and we take in which a basin for any region. That is a local paint to which all expletives of region is conveyed and thenceforward. Each i is introduced as a user.

j = 1, 2,..., n specifies the location of processing sets.

k = 1, 2,…, m specifies the location of sanitary landfills.

h= 1, 2, 3 specifies the type of processing technology.

(Compost = 3 recycling = 2 burner = 1)

2.8 Decision making variables

x_{y}^{h} : The amount of waste being transported from user i to processing or disposal system h in j group.

y_{jk}^{h} : amount at of waste, which is transported from disposal system h in-group j to k group sanitary landfill k.

s_{ik} :amount of waste that directly transported from users location i to sanitary landfill number k

z_{y}^{h} : Boolean variable, which specifies disposal system h in j position.

V_k :Boolean variable which specifies healthy sanitary landfill in k position.

Note :location, node, zone, region are introduction for city division

Following areas can be determined and identified by using the above said variables.

r_j^h: The amount of processed waste of h type in j group.

t_k : the amount of consumed waste in sanitary landfills.

2.9 In put data of problem

d_1: user's amount of request of I group (i = 1, 2,.., n). According to tonnage to be put under device.

C_{ab}: Transportation cost of each unit of weighty of expletives from a group to be group, a,b = 1,2,..,n.

P^h: percent of remained salvage out of disposal system of h type, which are needed to, be moved to sanitary landfill. K = 1, 2, 3,…, n.

Q_y^h : Maximum capacity of processing system of h type in j group. J = 1, 2, 3,…., n. h = 1, 2, 3.

$\bar{Q}_k$: Maximum capacity of sanitary landfill in k group. K = 1, 2, 3

δ^h : fixed charges of disposal system of h type in F_1 component of objective function.

γ^h : variable costs of disposal system of h type in F_1 component of objective function according to unit of weight

$\bar{\delta}$: Fixed charges of sanitary landfill in F_1 component.

$\bar{\gamma}$: Variant charges of sanitary landfill in F_1 component of objective function. According to weight unit.

μ_y^h : fixed charges of processing system of h type in j group in F_3 component.

η_y^h : Variable charges of processing system of n type in j group in F_3 component.

$\bar{\mu}_k$: Fixed charges of healthy sanitary landfill in k group in F_3.

$\bar{\eta}_k$: Variable. Charges of processing system of n type in j group in F_3

2.10 Model setting

1-first objective function can calculate the costs of investment and process system management.

F_1 = Transport costs + investment and processing system management and disposal costs

a) investment and processing system management and disposal costs

$$\sum_{h=1}^{3}\sum_{j=1}^{n}\left(\delta^h z_j^h + \gamma^h r_j^h\right)$$

b) Fixed and variable costs in consuming sets (sanitary landfill).

$$\sum_{k=1}^{n}\left(\bar{\delta} v_k + \bar{\gamma} t_k\right)$$

2-Direct and indirect Transportation Costs between in the areas.

a) transportation costs between areas

$$\sum_{h=1}^{3}\sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij} y_{ij}^h$$

b) Direct transportation charges from regions to sanitary landfill.

$$\sum_{i=1}^{n}\sum_{k=1}^{n} c_{ik} s_{ik}$$

c) indirect transportation charges (from disposal and processing systems to sanitary landfills).

$$\sum_{h=1}^{3}\sum_{j=1}^{n}\sum_{k=1}^{n}\left(c_{jk}y_{jk}^{h}\right)$$

$$F_1=\left[\sum_{h=1}^{3}\sum_{i=1}^{n}\sum_{j=1}^{n}\left(c_y x_y^h\right)+\sum_{i=1}^{n}\sum_{k=1}^{n}\left(c_{ik}s_{ik}\right)+\sum_{h=1}^{3}\sum_{i=1}^{n}\sum_{j=1}^{n}\left(c_{jk}y_{jk}^{h}\right)\right]+\left[\sum_{h=1}^{3}\sum_{j=1}^{n}\left(\delta^h z_j^h+\gamma^h r_j^h\right)+\sum_{k=1}^{n}\left(\bar{\delta}v_k+\bar{\gamma}t_k\right)\right]$$

F_2 = the second goal function is calculating the wide rubbish in time unit at consuming machines (in by rubbish repelling places.)

$$F_2=\sum_{k=1}^{n}t_k$$

F_3 = third goal function shows the amount of environmental effects of process and consuming machines and expenses of decreasing the environmental effects.

a) Resulting expenses of process machinery

$$\sum_{h=1}^{3}\sum_{j=1}^{n}\left(\eta_j^h z_j^h+\mu_j^h r_j^h\right)$$

b) Resulting expenses of hygienic reeling places existence

$$\sum_{k=1}^{n}\left(\bar{\eta}_k v_k+\bar{\mu}_k t_k\right)$$

Therefore – the criteria of third goal function is as below.

$$F_3=\sum_{h=1}^{3}\sum_{j=1}^{n}\left(\eta_j^h Z_j^h+\mu_j^h r_j^h\right)+\sum_{k=1}^{n}\left(\bar{\eta}_k v_k+\bar{\mu}_k t_k\right)$$

2.11 Constraints

With regard to the supposes and constraints which are explained and constraints. Which are explained in previous?

Mathematical formulas for restrictions are as below:

$\sum_{h=1}^{3}\sum_{j=1}^{n}x_y^h+\sum_{k=1}^{n}S_{ik}=d_i$ i , j, k=1, 2, 3,…, n h=1, 2, 3

$t_j^h\le\bar{Q}_j^h Z_j^h$ j=1, 2, 3,…, n h=1, 2, 3

$t_k\le\bar{Q}_k v_k$ k=1, 2,…, n

$\sum\rho^h x_y^h=\sum y_{jk}^h$ j=1, 2,…, n h=1, 2, 3

$\sum_h z_j^k\le 1$ j, k=1,2,…,n

$t_j^h=\sum_i x_{ij}^h$ i , j=1, 2,…, n h=1, 2, 3

$$t_k = \sum_i s_{ik} + \sum_h \sum_j y_{jk}^h \qquad k=1, 2,\ldots, n$$

These formulas define & specify below constraints:

1- The demand amount of space should be equal which the transported amount of rubbish to process machines and hygienic repelling places.

2- Capacity constraints of process machines and the amount of entered rubbish to process machines should lower or equal to the maximum capacity of the machine.

3- Capacity constraints of hygienic spelling places, the transported rubbish to the place should lower than the capacity of repelling place.

4- All the produced rubbish of process machine should consume.

5- The defined Constraints show that in each zone we can have just one process machine.

6- With using these factors, the amount of entered rubbish to process machine at area is shown.

7- The amount of sent rubbish from areas in direct stage to hygienic repelling places should equal with the consumed amount in K repelling place.

6 and 7 cases are not constraints but with introduced factors, we can find their quantity.

Variables must be non-negative.

With regard to the amount of entered waste.

Products to process machines and hygienic repelling place which can't be negative & the minimum amount of that is zero, so the below variables are not negative,

Therefore, we have:

$x_y^h \geq 0 \quad$ i, j=1, 2,..., n $\quad$ h=1, 2, 3

$y_{jk}^h \geq 0 \quad$ j, k=1, 2,..., n $\quad$ h=1, 2, 3

$s_{ik} \geq 0 \quad$ i, j=1, 2,..., n

$z_j^h = 0,1 \quad$ j=1, 2,..., n $\quad$ h=1, 2, 3

$v_k = 0,1 \quad$ k=1, 2,..., n

2.12 Conclusions and future direction

For optimizing.

$$\min F = \begin{vmatrix} F_1 \\ F_2 \\ F_3 \end{vmatrix}$$

We should build & solve this model according to Tabriz city information.

$$F=w_1f_1+w_2f_2+w_3f_3$$

Which in later papers of multi – purpose model, be solves & shown.

To produce the model with read numbers & parameters, the daily request of each area, Transportation expenses between areas, model pentameters, capacity of process machines, and capacity of hygienic.

Repelling places, amount of investment refurning, whole amount of investment, constant & changeable expenses in process machines and hygienic repelling place, coefficients and reduction of environmental effects, should calculate and put in the model.

In addition, with using multi – purpose or single – purpose programming software's, we can solve them.

future direction that using the application of decision support system (DSS) design to help decision makers of a municipality in the development integrated programs for solid waste management**.**

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ÇOXKRİTERİYALI HƏLL ÜSULUNDAN İSTİFADƏ EDƏRƏK ŞƏHƏRİN BƏRK CİSİM HALINDA OLAN TULLANTILARININ EMALININ İDARƏ EDİLMƏSİ SİSTEMİ

HÜSEYN FATEH

Məqalə iki hissədən təşkil olunmuşdur. Birinci hissədə bir parametr üzrə proqramlaşdırma üsulu haqqında qısa məlumat verilir, üsulun zəif və üstün cəhətləri şərh olunur. İkinci hissədə həll alqoritmi ilə qısa tanışlıqdan sonra şəhərin bərk cisim halında olan tullantılarının emalının idarə olunması modeli şərh olunur və bu modelin istifadəsinə aid bir misal göstərilir. Bu hissədə qəbul olunmuş model əsasında maşın hesabatı təqdim olunmaqla tam ədədi proqramlaşma və bölünmə alqoritmindən istifadə edərək məsələnin həlli verilmişdir.

СИСТЕМА УПРАВЛЕНИЯ ПЕРЕРАБОТКОЙ ТВЕРДЫХ ОТХОДОВ ГОРОДА С ИСПОЛЬЗОВАНИЕМ МЕТОДОВ МНОГОКРИТЕРИАЛЬНОГО ПРИНЯТИЯ РЕШЕНИЯ

ХОСЕЙН ФАТЕХ

Статья содержит две части. В первой части приводится краткая информация о методе отдельного параметрического программирования и путях его решения, вскрываются слабые и сильные стороны этого метода. Во второй части, после короткого знакомства с алгоритмом решения, даются модель системы управления переработкой твердых отходов города и один из примеров ее использования. В этой части с представлением машинного решения, используя целочисленное программирование и алгоритм разделения, дается решение согласно принятой модели.