MINISRTY OF EDUCATION AND SCIENCE,
YOUTH AND SPORTS OF UKRAINE
National Aviation University

NETWORKS AND DATABASES

Term paper Method Guide
for students of field of study 6.070102
«Aeronavigation»

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Compilers: *S.M. Kredentsar, H.V. Babij*

Reviewer *N.M. Lobanchikova*

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Методичні рекомендації містять вимоги до виконання та оформлення курсової роботи, математичну постановку задачі синтезу системи передачі даних та методику розрахунків її компонентів та параметрів, а також список літератури.

Для студентів напряму підготовки 6.070102 «Аеронавігація».

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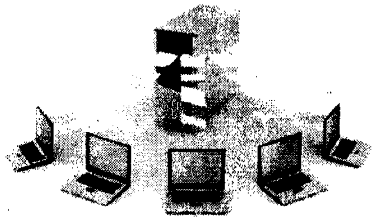
The Term Paper Method Guide contains the mathematical problem statement of DATS synthesis and the method of its components and parameters calculation, the requirements to the term paper preparation, and references.

The Guide is intended for students of the field of study 6.07102 "Aeronavigation".



INTRODUCTION

The term paper "Synthesis of DATS" is performed according to the syllabus of the discipline "Networks and databases" with the aim of deepening and improving the theoretical knowledge and mastering the practical skills obtained by students while studying the educational material of this discipline in the field of computer-aided networks and databases.

The main purpose of the term paper is to master the fundamental knowledge of local computer networks and to obtain practical skills in this field.

As a result of the term paper execution students must:

know:

– what is a DATS and its basic components;
– what is a server and a hub;
– the stages of DATS synthesis;
– the tasks to be solved at each stage of DATS synthesis;

be able to:

– design structurally and choose project decisions for DATS;
– choose necessary equipment and location of DATS elements.

1. PURPOSE AND TASK OF THE TERM PAPER

Mastering the fundamental knowledge of local computer networks and obtaining skills in a computer network synthesis of data transmission system is aimed at the term paper execution.

The task of the term paper is to study and to master computer network DATS synthesis process which includes the following stages:

1. DATS structure design.
2. Determination of coordinates of DATS elements location.
3. Calculation of the optimal DATS equipment configuration.
4. DATS costing.

2. INITIAL DATA AND EXECUTION ORDER OF THE TERM PAPER

DATS, which must be designed, consists of: sources of information (SI), hubs, communication channels and central computers. In this case, the main purpose of hubs is to receive data from SI through low-speed and medium-speed communication channels with their further transmission through high-speed communication channels to a central computer.

The number and coordinates of sources of information, types of possible equipment for every SI, equipment cost in network segments and operational expenses for data transmission for a period of 300 days are given as initial data for DATS design.

Initial data is given in the tables below:

1. Coordinates of SI, transmitted information volume (table 1);
2. Types of equipment, their bandwidth and cost (table 2);
3. The communication channels lease cost per time unit (table 3).

Table 1

Sources of information

Number of SI	Coordinates of SI, km		Information volume
	X	Y	Kbytes
1	0	0	460
2	20	0	360
3	40	0	200
4	60	0	240
5	80	0	500
6	100	0	800
7	0	20	1200
8	20	20	860
9	40	20	580
10	60	20	140
11	80	20	580
12	100	20	860
13	0	40	1200
14	20	40	800
15	40	40	500
16	60	40	240

The end of table 1

Number of SI	Coordinates of SI, km		Information volume
	X	Y	Kbytes
17	80	40	200
18	100	40	360
19	0	60	460
20	20	60	240
21	40	60	500
22	60	60	800
23	80	60	1200
24	100	60	860
25	0	80	200
26	20	80	240
27	40	80	500
28	60	80	800
29	80	80	1200
30	100	80	860

Table 2

Type of equipment

N	Transfer rate, bps	Cost
1	50	7000
2	75	20000
3	100	50000
4	200	110000
5	600	210000
6	1200	350000

Table 3

Channels lease

Distance, km	Lease cost per 1 minute
100	50
600	150
1200	250
3000	300

For the DATS synthesis it is necessary to complete 4 stages, which were described before. Any DATS consists of network segments. In this case, DATS, which must be designed, can consist of a few network segments, moreover SI, a hub and a server can be a component of any network segment. So, on the first stage of DATS design it is necessary to define the number of network segments in DATS. Then, in accordance with this, the number of hubs, servers and their coordinates is defined. Thereby the initial configuration of DATS is determined.

Having received the initial coordinates, it is necessary to move a hub and a server at the optimal positions. The process of optimal hub move can be named as the deformation of a network segment. Hereby the minimization of distances sum is carried out between a data hub and SI.

One of six equipment types (table 2) with the definite data transmission rate and cost can be placed in any network element, besides the communication channel lease cost depends on the distance (table 3). Therefore the DATS synthesis foresees the necessity to select the equipment from a given set of types, placing them in a certain SI and attaching a hub to them in the way of minimizing the communication channels lease and equipment cost.

On the final stage, before the calculation of DATS cost, it is necessary to perform the secondary deformation of the network segments, i.e. to clarify the hub and server coordinates taking into account the minimum equipment and channels lease cost. Thus, for the DATS synthesis of a computer network it is necessary to complete the following steps:

1. To determine the number of hubs.
2. To calculate the hub and server coordinates in terms of minimum distance.
3. To clarify the server and hub coordinates.
4. To clarify the equipment types.
5. To clarify the hub and server coordinates taking into account the minimum equipment and channels lease cost.
6. To calculate the DATS cost.

Modern methods of solving the following tasks involve the use of machine methods for calculations. As DATS synthesis is the task of nonlinear programming, in order to perform the calculations while DATS synthesis, it is necessary to develop the computer program to perform calculations for all DATS parameters.

The variant of initial data for performing the term paper is selected in accordance with the number of a student in the group list. The variants of the tasks for the term paper are listed in the table 4.

Table 4

Variants of tasks for the term paper

Number of variant	Numbers of sources of information
1	1,2,7,8,16,17,18,24,26,30
2	1,2,8,9,20,21,26,28,29,30
3	1,4,5,10,11,18,25,26,27,30
4	7,8,13,14,17,18,23,24,27,29
5	2,3,4,9,10,19,21,23,26,27
6	2,5,6,7,8,17,18,22,23,25
7	2,4,10,11,16,17,19,26,27,30
8	3,4,5,9,13,18,19,20,27,28
9	3,6,8,9,12,14,15,17,18,28
10	3,5,12,16,22,23,24,25,28,29
11	4,5,6,10,11,12,19,21,28,29
12	4,7,8,10,11,14,15,16,24,25
13	4,5,7,11,14,15,16,17,25,30
14	5,6,8,11,12,14,20,23,24,29
15	5,8,11,13,14,17,18,20,21,30
16	5,8,9,17,18,19,23,24,27,30
17	6,11,12,14,15,19,20,21,24,30
18	6,9,10,15,16,17,19,23,24,27
19	6,13,14,16,19,20,23,24,26,29
20	6,8,9;17,22,23,24,25,27,29
21	1,2,7,8,16,23,24,25,27,29
22	1,2,8,9,20,23,24,25,26,29
23	1,4,5,10,11,19,20,21,24,30
24	2,3,4,9,10,19,23,24,27,30
25	2,5,6,7,8,17,18,20,21,26
26	2,4,10,11,16,20,23,24,29,30
27	3,4,5,9,13,15,16,17,25,30
28	3,6,8,9,12,18,19,21,28,29
29	3,5,12,16,22,23,25,27,28,29
30	3,4,6,11,12,15,21,22,27,30
31	4,5,6,10,11,17,18,24,26,30
32	4,7,8,10,11,21,26,28,29,30

The end of table 4

Number of variant	Numbers of sources of information
33	4,5,7,11,14,18,25,26,27,30
34	5,6,8,11,12,18,23,24,27,29
35	5,8,11,13,14,19,21,2326,27
36	5,8,9,17,18,19,20,22,23,25
37	6,11,12,14,15,17,19,26,27,30
38	6,9,10,15,16,18,19,20,27,28
39	6,13,14,16,19,20,22,23,28,30
40	6,8,9,17,22,23,24,25,28,29
41	1,2,5,9,10,17,20,23,25,29
42	2,5,10,11,15,18,24,28,29,30
43	3,5,6,8,9,10,19,21,24,27
44	4,7,8,12,14,17,23,24,26,30
45	5,8,11,15,16,19,23,24,26,30
46	1,6,k9,10,14,17,18,19,24,28
47	2,5,8,11,1318,19,21,25,29
48	3,4,8,10,14,18,19,22,26,30
49	4,6,7,9,10,11,16,20,23,27
50	5,6,11,12,14,18,19,21,23,30
51	1,3,4,12,14,17,23,28,26,30
52	1,5,8,11,15,17,19,23,24,26,
53	1,6,9,10,14,19,21,22,24,28
53	2,5,8,11,15,18,19,23,25,29
55	3,4,8,11,14,18,19,24,26,30
56	4,5,7,9,10,11,16,20,25,27
57	5,6,11,12,15,18,19,21,27,30
58	3,7,8,12,14,18,23,24,26,30
59	5,9,11,15,16,20,23,24,26,30
60	1,2,9,10,12,17,18,19,24,28

3. THE TERM PAPER PREPARATION ORDER

The term paper preparation must include:

– Title of the term paper;

– Surname, name of a student, the number of student`s record book and academic group;

– Variant number;

– Calculation part;

– Structural scheme of the designed DATS;

– Program part (developed program to calculate the cost and parameters of DATS);

– Results of program calculations.

The solution must be accompanied by explanations and references to the literature.

All figures must be performed in the same way.

Formulas must be given in algebraic form firstly, with the formulas signs and units explanation.

The list of references must be given at the end of the term paper.

The program listing for calculating the DATS parameters must be given in appendixes.

The format of the explanatory note is the following:

– title-page, prepared in accordance with APP. 1;

– the list of tasks for the term paper (APP. 2);

– the list of schedule for performing the term paper (APP. 3);

– the list of abbreviations used in the explanatory note;

– summery containing brief information about the structure and content of the explanatory note (app. 4);

– the content of the term paper;

– introduction up to 2 pages;

– the main part of the explanatory note (the analysis of the initial data, the order of calculations, intermediate results and their analysis, the description of the program);

– conclusions;

– references;

– appendixes.

Requirements to the explanatory note:

– the explanatory note must be divided into sections and subsections and they must be named and numerated;

– page setup: page size is standard A4, i.e. 210×297 mm, orientation is portrait; all margins are 25 mm; catchwords are 17 mm;

– text is Times New Roman 12pt, with paragraphs, on the page width;

– enumerate all figures, formulas and tables, taking into account sections and subsections number;

– formulas must be typed with the help of Eguation Editor (option of Microsoft Word for Windows);

– enumerate all pages;

– references order: for books-author's surname and initials (in italics), book title, volume number, the place of publication and publishing house, year, the number of pages; for the magazine – author's surname and initials (in italics), title, magazine title, place of publication and publishing house, year of publication, issue, the number of pages.

4. THEORETICAL DATA

4.1. Mathematical problem statement of data transmission system synthesis

Let there is a variety of equipment types $A=\{a_1,a_2...a_m\}$ and a variety of bandwidths $V=\{\nu_1,\nu_2...\nu_m\}$ respectively and a variety of costs $W=\{w_1,w_2...w_m\}$.

The location coordinates $X_j, Y_j (j=1...n)$ and data transmission volume g_j per day are given for each SI, where n is a number of sources of information in network segments. Maximum speed of a hub output channel equals B. Each source of information can contain only one type of equipment:

$$\alpha_{i,j}=\begin{cases}1 - \text{if j-th SI is connected to the i-th type of equipment;}\\ 0 - \text{otherwise.}\end{cases}$$

So:

$$\sum_{j=1}^{m}\alpha_{i,j}=1, \text{ for any } j=1..m.$$

And

$$\sum_{i=1}^{n}\sum_{j=1}^{m}\alpha_{i,j}=n.$$

While the total data transmission rate must not exceed the initial speed of the hub (1):

$$\sum_{i=1}^{n}\sum_{j=1}^{m}\nu_i\cdot\alpha_{i,j}\le B. \tag{1}$$

The equipment cost is:

$$R=\sum_{i=1}^{n}\sum_{j=1}^{m}w_i\cdot\alpha_{i,j}$$

The communication channels lease cost is:

$$L=\sum_{i=1}^{n}\sum_{j=1}^{m}C_j\cdot\alpha_{i,j}\cdot t_{i,j}\cdot T_0$$

where T_0 is the considered time interval (T_0 = 300 days, B = 1200 bps); C_j is the communication channel lease cost while transmitting from 'j which is the source of information to the hub per time unit; $t_{i,j} = \frac{g_j}{v_i}$ is the time of data transmission per day from the j-th SI.

The total cost of both equipment R and communication channels lease L is the following (2):

$$F = \sum_{i=1}^{n}\sum_{j=1}^{m} \alpha_{i,j} \cdot d_{i,j}\,, \tag{2}$$

where $d_{ij} = w_i + t_{i,j} \cdot C_j \cdot T_0$.

The task of the network segment synthesis is formulated as a task of functional minimization (2) while performing the limitations (1).

4.2. The procedure of dats synthesis

At the first stage the task of network segments selection is solved. For this purpose, the total number of hubs is determined and SI binding is provided.

A hub is a device that allows concentrating data transmission channels. The method of concentration is a dynamic channel assignment procedure in which a part of input channels, in accordance with the coming requests, are dynamically distributed among a smaller number of output channels. As a rule, the output channels are faster.

The number of hubs is determined by the following algorithm:

STAGE 1. For each source of information we make the list K of its nearest neighbours (K = 3 is a design parameter) and determine the frequency of each source of information appearance in the lists ω_j.

If $\omega^* = max\,\omega_j$, then for j-th SI $1 \le \omega_j \le \omega^*$.

All SI with the same frequencies are recorded in the list S_l.

We should calculate the lower limit of the classes frequency that are the subject of consideration:

$$\omega_{cp} = \left[\frac{1}{n} \cdot \sum_{l=1}^{\omega^*} l \cdot Z_l \right] + 1,$$

where Z_l is the number of SI in the list S_l; [ ] is the integer part of the number; N is the total number of SI in the network.

STAGE 2. We should determine the initial multitude of candidates for the hub S_{ω^*}, then add it to the SI in descending order of frequency $\omega_{cp} \leq 1 \leq \omega^*$. Their number is limited above by $n/2$.

At the second stage the initial coordinates of the hub and server of each network segment are determined. The initial coordinates of the hub are determined as average coordinates of SI of the network segments.

$$x_1 = \frac{1}{n} \cdot \sum_{i=1}^{n} x_i \,;\, y_1 = \frac{1}{n} \cdot \sum_{i=1}^{n} y_i \,,$$

where x_1, y_1 are the coordinates of the hub in the network segment; n is the number of SI in the network segment.

In the case of the server it is necessary to take into account that SI as well as the hub will be connected to it:

$$x_c = \frac{1}{m} \cdot \sum_{i=1}^{m} x_i \,;\, y_c = \frac{1}{m} \cdot \sum_{i=1}^{m} y_i \,,$$

where x_c, y_c are the coordinates of the server; m is the number of SI, that are connected to the server and the number of hubs in DATS.

Then the method of the gradient descent is used. The functional is minimized when X_l and Y_l are changed:

$$F(x_1, y_1) = \sum_{i=1}^{n} \sqrt{(x_1 - x_i)^2 + (y_1 - y_i)^2} \,.$$

We receive the clarified coordinates of the hub X_l and Y_l.

To solve this problem it is necessary to use computers.

At the third stage for each network segment the optimal configuration, bandwidth of communication channels and the equipment type for each SI are determined. The functional (2) is minimized at the limitation (1). The algorithm of solving the problem is the following: the matrix $D = \{d_{ij}\}$, i=1..n is composed in accordance with (2). The functional (2) exceeds an absolute minimum only if in each column of matrix D, the minimal element is selected. If the limitation (1) is applied, the task is solved. While failing the limitation it is necessary to refuse the minimal element in one of the columns and select the nearest one to it.

The column with the minimal fine coefficient should be chosen.

$$k_j = \frac{\Delta_j^*}{\Delta_j} \,, j=1..n \,.$$

Here:

$$\Delta_j^* = \left| d_{min,j} - d_{min+1,j} \right|;$$

$$\Delta_j = \left| \nu_{min} - \nu_{min+1} \right|,$$

where $d_{min,j}$ and $d_{min+1,j}$ are the minimal and the nearest elements of the first column; ν_{min} and ν_{min+1} are equipment bandwidths related to $d_{min,j}$ and $d_{min+1,j}$.

At the fourth stage the coordinates of the hub and the server of the network segments are clarified, taking into account the values of data streams through SI. Thus, with the method of the fastest descend the functional is minimized:

$$F(x_1, y_1) = \sum_{i=1}^{n} \frac{g_i}{\nu_i} \sqrt{(x_1 - x_i)^2 + (y_1 - y_i)^2} .$$

The obtained result is considered as the final.

4.2.1. The clarification of hub and server coordinates

Having received the initial coordinates, it is necessary to carry out the optimal relocation of the hub and the server. The process of optimal relocation of a hub (with appropriate limitations) is called the deformation of network elements. The initial deformation, described in this section, consists in the use of methods of coordinate and gradient descent to clarify the position of the network element. At the same time it is necessary to carry out the minimization of the sum of distances between the hub and SI.

The minimized functional is:

$$F(x_1, y_1) = \sum_{i=1}^{n} \sqrt{(x_1 - x_i)^2 + (y_1 - y_i)^2} . \qquad (3)$$

The same process must be done for the server.

The algorithm of the coordinates calculation.

1. We should perform the search of initial approximation of the node coordinates, minimize the specified functional (3) by the method of gradient search. We determine the functional gradient $F(x_1, y_1)$ at the point of initial approximation:

$$B1 = \sum_{i=1}^{n} \frac{x1 - xi}{\sqrt{(x_1 - x_i)^2 + (y_1 - y_i)^2}};$$

$$B2 = \sum_{i=1}^{n} \frac{y1 - yi}{\sqrt{(x_1 - x_i)^2 + (y_1 - y_i)^2}}.$$

We should perform the calculation $\sqrt{B1^2 + B2^2} < e$, where $e \approx 0{,}01$ is accuracy.

If the module $\sqrt{B1^2 + B2^2}$ is less than accuracy, it means that the necessary coordinates of the node are found. If the module $\sqrt{B1^2 + B2^2}$ is not less than accuracy you should perform the second step.

2. Otherwise, we proceed to the method of "golden section". This method in comparison with others, requires the lowest amount of calculations. It is used for the unimodal function of one variable and provides the narrowing of uncertainty interval to the specified accuracy (fig. 18). The interval *[a, b]* is divided into two unequal parts in the way that the ratio of the length of the larger segment to the total length of the interval equals to the ratio of the length of the smaller segment to the length of the larger segment ("golden section"):

$$\frac{Z_1}{Z} = \frac{Z_2}{Z_1},\ Z_1 + Z_2 = Z;$$

$$Z_2 / Z_1 = \left(\sqrt{5} - 1/2 \approx 0.618\right).$$

At each step the uncertainty interval is illuminated in 1/0,618 times. In order to determine the interval on the next stage it is necessary to make the step from the point *a* to fulfil the next condition: F (b) <F (a). Let $a = H_0$, $b = H_1$, then new points are calculated by the formulas (4):

$$\begin{aligned} H_2 &= H_0 + 0.382(H_1 - H_0); \\ H_3 &= H_1 - 0.382(H_1 - H_0). \end{aligned} \tag{4}$$

We calculate $F\ (H_2)$ and $F\ (H_3)$, if $F\ (H_2) < F\ (H_3)$, then $H_3 = H_1$ is the right limit changed, otherwise $H_0 = H_2$ is the left limit changed.

The process continues until $H_1 - H_0$ is not less than a given accuracy.

3. We perform a descent in the direction of anti-gradient. The initial step of descent is selected as a distance from the starting point to the nearest SI. We determine an intermediate value:

$$VX = X - HB,$$

where B is a gradient vector; H is a initial step. The optimal value of the step H is defined by carrying out one-dimensional search in the direction of anti-gradient. First of all, it is necessary to find the interval of uncertainty. Let's assign the value to the functional *F(X)*, calculated in the previous stage, by the variable $D = F(X)$. If $D > F(VX)$, where $F(VX)$ is the functional value in the current step, then we increase the step.

4. To increase the step it is necessary to assign $D = F(VX)$, calculated at the third step. Let determine a new value $H = H + H_1$ and $VX = X - HB$. Let make verification $D > F(VX)$; if $D < F(VX)$, then we find the uncertainty interval.

5. Let's assign $H_0 = 0$ and $H_1 = H$, where H was calculated previously. Then we calculate *F(X)* in new points:

$$F_0 = F(X - H_0 B);$$

$$F_1 = F(X - H_1 B).$$

6. We determine new value points by the formulas (4) and calculate the functional *F(X)* in the defined points:

$$F_2 = F(X - H_2 B);$$

$$F_3 = F(X - H_3 B).$$

We make verification: If $F_2 \le F_3$, then the right limit has changed, i.e. $H_1 = H_3$, otherwise, the left limit have changed, i.e. $H_0 = H_2$. Then we make a comparison $H_1 - H_0 < e$. If the condition is fulfilled it is necessary to equalize $H = H_2$. Then we recount the values of x and y.

4.2.2. The determination of the optimal equipment configuration

At this stage of DATS synthesis it is necessary to make one more deformation of the network element in order to determine the optimal equipment configuration, communication channels lease cost and channels bandwidth.

We use the algorithm for the basic problem of the deformed network segment in order to determine the optimal equipment configuration of data transmission, optimal values of communication channels operating cost, the location of equipment types on the appropriate SI and to obtain the bandwidth values of communication channels.

The initial parameters of the algorithm: n is the number of SI; L=6 is the number of equipment types; W (L) is the equipment cost; G (P) are daily volumes of information from the appropriate SI; T_0 = 300 is the time in working days; x_1, y_1 are the coordinates of the hub after the primary deformation of the network element.

The communication channels lease cost is determined according to the coordinates of the SI and the hub. Generally, the function of the communication channels lease cost C_i has the stepped nature and can be calculated as:

$$L = \sum_{j=1}^{n} t_j * C_j ,$$

where C_i is the communication channel lease cost per time unit while the hub is located in the i-th zone for the j-th SI. C_i, corresponds to the certain zone within the zone range C_i = const, and the distance of the hub from the appropriate SI is determined by the expression:

$$R = \sqrt{(x_1 - x_j)^2 + (y_1 - y_j)^2} ,$$

where x_1, y_1 are the coordinates of the hub; x_i, y_i are the coordinates of SI.

Thus, the hub attribution to the appropriate zone depends on the distance to the j-th source of information that is nonlinearly determined by their coordinates.

The calculation order:

1. The calculation of distances from the hub to the data sources. According to them set of communication channels leases C_j is constructed.
2. The matrix D compiling, the elements of which are:

$$d_{i,j} = w_i + g_i / v_i * T_O * C_j ,$$

where i = 1, 6 are the equipment types; j = 1, n is the number of SI.

3. The minimum values of the matrix D are located in each column and the row numbers are fixed.
4. In order to select the numbers of equipment types the bandwidth is summed up, and if the condition is fulfilled (1), then the selected configuration is optimal.

5. Otherwise, the element above is taken in each column and the coefficients of fines for each column are calculated:

$$K_j = \Delta * j / \Delta j ,$$

where $\Delta * j = |d_{min\,j} - d_{min} + l_j|$; $\Delta j = |v_{min} - v_{min} + l|$.

6. We find the minimum value of the fine coefficient. A new element is selected in the column, which is related to the minimum value of the fine coefficient.

4.2.3. The calculation of DATS cost

Having defined the equipment configuration in the previous sections, it is possible to calculate the data transmission system cost. The cost is influenced by the equipment types and distances from SI to the network elements.

The equipment cost:

$$R = \sum_{i=1}^{m}\sum_{j=1}^{n} w_i * a_{i,j} ,$$

where n is the number of SI of this equipment type; w_i is the equipment types cost installed to i-th SI and the hub.

The communication channels lease cost:

$$L = \sum_{i=1}^{m}\sum_{j=1}^{n} C_j * a_{i,j} * g_j / v_i * T_0 ,$$

where C_j is the communication channel lease cost, while transmitting from the j-th SI to the hub per time unit; g_j is the information volume transmitted per day; v_j is the bandwidth, set to the j-th hub; T_0 is the considered time interval.

The total equipment and communication channels lease cost:

$$F = \sum_{i=1}^{m}\sum_{j=1}^{n} a_{i,j} * d_{i,j} ,$$

where $d_{i,j} = w_j + C_j * g_j / v_j * T_0$

5. SELF-CHECK ASSISMENT

1. What is the purpose of the term paper?
2. Give the definition for a hub.
3. Give the definition for a server.
4. Give the definition for a DATS.
5. What are the main stages of DATS synthesis?
6. Describe the algorithm for determining the number of hubs.
7. Describe the algorithm for determining the optimal equipment configuration.
8. Describe the algorithm for determining the coordinates of a hub and a server.
9. Describe the algorithm for coordinates clarification of a hub taking into account the values of data streams from the sources of information.
10. What is the method of «golden section» used for?
11. What is the main purpose of a hub?
12. Describe the algorithm for communication channels lease costing.
13. Give the formulas for calculating the initial coordinates of a hub and a server.
14. What are the differences in functionals, which are minimized at the second and the 4th stages of DATS synthesis?
15. List the tasks to be solved at each stage of DATS synthesis.
16. Describe the procedure of DATS costing.

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APPENDIX 1

Title-page sample

NATIONAL AVIATION UNIVERSITY

Air Navigation Systems Department

TERM PAPER

SYNTHESIS OF DATA TRANSMISSION SYSTEM (DATS)

on the discipline

«Networks and databases»

Student of group 205, IAN

__________ /Stetsenko I. A./

Supervisor

__________ /Kredentsar S.M./

Date: 29.05.11

Kyiv 201_

APPENDIX 2

____

University name

Department______________________________________

Discipline_______________________________________

Specialty ______________________________________

Academic year_________ Group_______ Term ______________

TASK

for the term paper

____

Name, Surname

1. The theme of the term paper: Synthesis of data transmission system
2. The deadline for passing the term paper:___________________

____

____

____

3. The term paper initial data:_________________________

____

____

4. The content of the explanatory note:___________________

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5. The date of the task assigning: 10.03.2011___________________

SCHEDULE

№	Name of the term paper stages	Execution period of the term paper stages	Comments

Student ______________________

(signature)

Supervisor

______________ ______________________

(signature) Name, surname

“ ” ______________ 201_

APPENDIX 4

SUMMERY

The term paper contains:

- pages – 43;
- pictures – 4;
- tables – 4;
- appendixes – 4;
- sources – 4.

The theme of the term paper –
The aim of the term paper –

The execution order of the term paper:

The structure of the explanatory note:

The results of the term paper execution –

Key words:

Навчальне видання

МЕРЕЖІ ТА БАЗИ ДАНИХ

Методичні рекомендації до виконання курсової роботи для студентів напряму підготовки 6.070102 «Аеронавігація»

(Англійською мовою)

Укладачі:
КРЕДЕНЦАР Світлана Максимівна
БАБІЙ Галина Вікторівна

Технічний редактор *А.І. Лавринович*
Комп'ютерна верстка *Н. В. Чорної*

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