

Синтез структуры пятимерной измерительной системы

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Synthesis of the structure of the five-dimensional measuring system

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The problem of synthesis of multidimensional systems is the lack of algorithms for solution, as well as the lack of evaluation of the accuracy of solutions. This article presents a system for monitoring the atmospheric electrostatic field by five input parameters: meteorological (atmospheric pressure, air temperature, wind speed) and geophysical (level of radioactive background and humidity). The purpose of the article is to determine the function of the target for the parameters of the input signals of the devices, to reduce the error at the output of the system. The resulting system is implemented on the basis of two-dimensional and three-dimensional systems. During the work the following steps were performed: 1) representation of a multidimensional system in the form of a C-graph; 2) development of a mathematical model in the form of a system of equations.

Keywords: multidimensional system; operator; system of equations; constraint system; goal function.

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), D, K, L, F, G;

электростатического поля.

Для трехмерной системы (x1, x3, x5)

$$\left. \begin{aligned} x_1 &= \frac{x_8}{AD} \sqrt{1 - b^2 B^2 D^2 - g^2 C^2 D^2} \\ x_3 &= b x_8 \\ x_5 &= g x_8 \\ 0 &\leq b \leq 1.0; \\ 0 &\leq g \leq 1.0; \\ B^2 b^2 + C^2 g^2 &\leq \frac{1}{D^2} \end{aligned} \right\} \quad (1)$$

Для двумерной системы (x9, x11) вид:

$$\left. \begin{aligned} x_9 &= \frac{x_{14}}{FM} \sqrt{1 - a^2 N^2 F^2} \\ x_{11} &= a x_{14} \\ 0 &\leq a \leq \left| \frac{1}{NF} \right| \leq 1 \end{aligned} \right\} \quad (2)$$

Для двумерной системы (x8, x14) вид:

$$\left. \begin{aligned} x_8 &= \frac{x_{16}}{KG} \sqrt{1 - \gamma^2 L^2 G^2} \\ x_{14} &= \gamma x_{16} \\ 0 &\leq \gamma \leq \left| \frac{1}{LG} \right| \leq 1 \end{aligned} \right\} \quad (3)$$

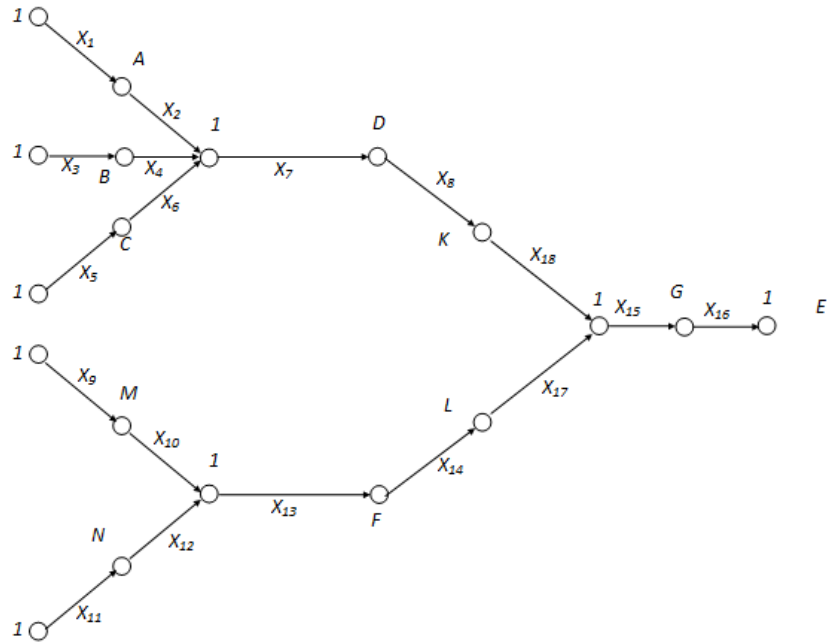
Из (1) и (3) находим уравнения примут вид:

$$\begin{aligned} x_1 &= \frac{x_{16}}{AD \cdot KG} \sqrt{(1 - b^2 B^2 D^2 - g^2 C^2 D^2)(1 - \gamma^2 L^2 G^2)} \\ x_3 &= \frac{x_{16} \cdot b}{KG} \sqrt{1 - \gamma^2 L^2 G^2} \\ x_5 &= \frac{x_{16} g}{KG} \sqrt{1 - \gamma^2 L^2 G^2} \end{aligned}$$

Из (2) и (3) уравнения примут вид:

$$\begin{aligned} x_9 &= \frac{\gamma x_{16}}{FM} \sqrt{1 - a^2 N^2 \cdot F^2} \\ x_{11} &= a \cdot \gamma x_{16} \\ 0 &< \gamma \leq \left| \frac{1}{GL} \right| \quad 0 < a \leq \left| \frac{1}{NF} \right| \end{aligned}$$

1				855–1053
3				-60...+40
5		V	/c	0–35
9			/	0–1000
11			%	40–98
16			/	0–2000



1. - структура системы

В результате получена система уравнений для пятимерной системы:

$$\begin{aligned}
 x_1 &= \frac{x_{16}}{AD \cdot KG} \sqrt{(1 - b^2 B^2 D^2 - g^2 CD)(1 - \gamma L^2 G^2)} \\
 x_3 &= \frac{x_{16} \cdot b}{KG} \sqrt{1 - \gamma L^2 G^2} \\
 x_5 &= \frac{x_{16} g}{KG} \sqrt{1 - \gamma L^2 G^2} \\
 x_9 &= \frac{\gamma x_{16}}{FM} \sqrt{1 - a^2 N^2 F^2} \\
 x_{11} &= a \cdot \gamma x_{16}
 \end{aligned}
 \tag{4}$$

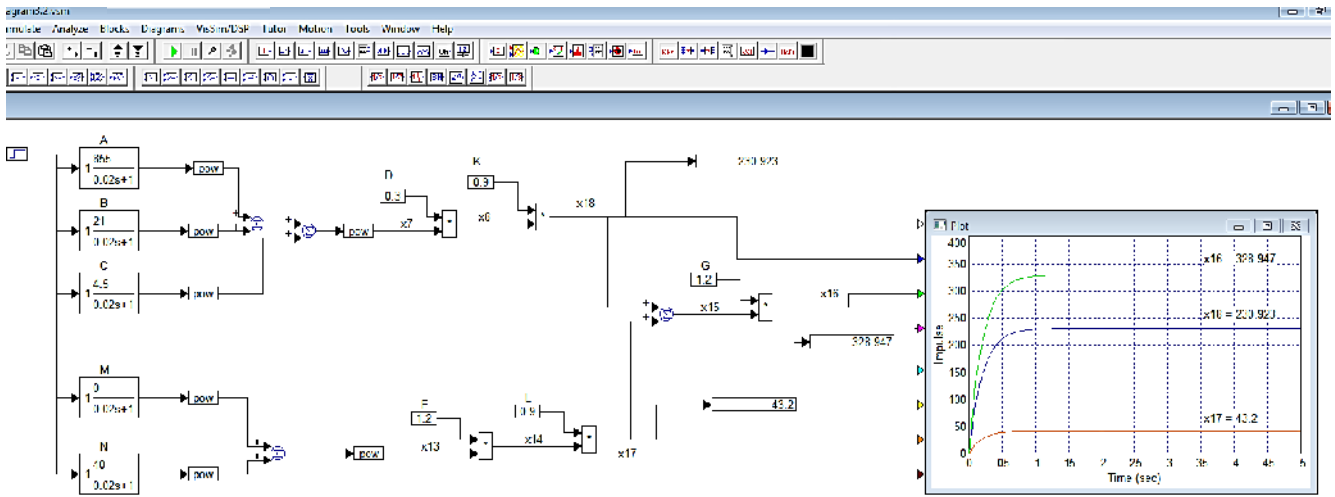
- 0 $A \leq 1,0$
- 0 $B \leq 1,0$
- 0 $C \leq 1,0$
- 0 $M \leq 1,0$
- 0 $N \leq 1,0$
- 0 $D \leq 1,0$
- 0 $F \leq 1,0$
- 0 $0 \leq G \leq 1,0$

Функция цели:

$$\begin{aligned}
 x_{01} &= x_1(1 - A) \\
 &= \frac{x_{16}(1 - A)}{AD \cdot KG} \sqrt{(1 - b^2 B^2 D^2 - g^2 C^2 D^2)(1 - \gamma L^2 G^2)} = \\
 &\min=0
 \end{aligned}$$

Ограничения на:

- 0 $b \leq 1,0$
- 0 $g \leq 1,0$
- 0 $B^2 b^2 + C^2 g^2 \leq \frac{1}{D^2}$
- 0 $a \leq \left| \frac{1}{NF} \right| \leq 1,0$
- 0 $\gamma \leq \left| \frac{1}{LG} \right| \leq 1,0$



2.

VisSim

1) $M = 0,9; N = 0,9; L = 0,9; K = 0,9; D = 0,3; F = 1,2; G = 1,2.$

2) $M = 0,9; N = 0,9; L = 0,9; K = 0,9; D = 0,3; F = 1,2; G = 1,2.$

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