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SOLUTION OF MATRIX DYNAMICS EQUATIONS IN CONTROL PROBLEMS IN MATLAB /SIMULINK/

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Many problems of optimal synthesis are associated with the solution of Riccati, Lyapunov and etc. equations. Furthermore, while solving linear differential equations of dynamics, there arises necessity for determining a fundamental matrix. This matrix is determined from the solution of a matrix equation with initial condition in the form of a unit matrix.

The solution of matrix equations of linear algebra is also considered in the report.

Various schemes of solutions on the pack of block visual imitational simulation *Simulink* are suggested.

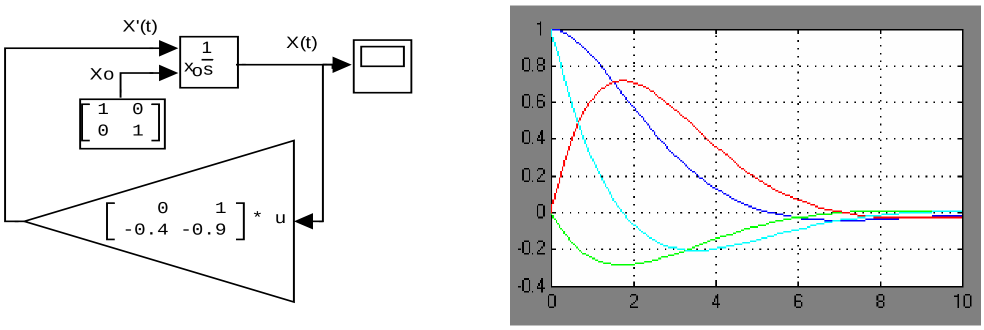
We demonstrate the solution of the linear matrix equation

$$dX/dt = AX, \quad X(0) = X_0, \tag{1}$$

where $X = (x_{ij})$ are state variables; $i, j = \overline{1,n}$; A is a constant matrix of the system.

The simulation scheme (a) and the results of the solution $x_{ij}(t)$ (b) are shown in the form of a graph for

$$A = \begin{pmatrix} 0 & 1 \\ -0{,}4 & -0{,}9 \end{pmatrix}, \quad X(0) = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}.$$



a) б)

Fig.1

We also consider the solution of the linear equation

$$Ax = b. \tag{2}$$

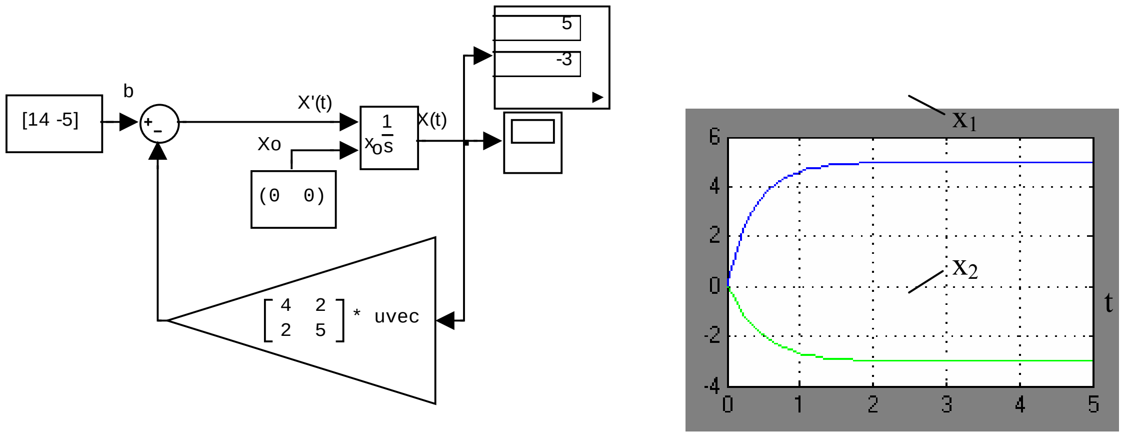
For realizing in the *Simulinkin* pack, equation (2) is reduced to the form

$$dx/dt = -Ax + b, \quad x(0) = 0. \tag{3}$$

The problem is reduced to the solution of linear differential equation (3). Solution (2) is the steady value of this equation. The positive definiteness of the matrix A is a sufficient condition providing establishment of transients. By Sylvester's condition, for positive definiteness of the digital matrix, all its diagonal minors should be positive.

The simulation scheme (a) and the results of the solution (b) are shown in fig. 2 for

$$A = \begin{pmatrix} 4 & 2 \\ 2 & 5 \end{pmatrix}, \quad b = \begin{pmatrix} 14 \\ -5 \end{pmatrix}.$$



a) б)

Fig.2

As it is seen from figure.2,b, the steady values $x_1 = 5$ and $x_2 = -3$ are the solutions of equation (2).

The obtained results may be used while solving nonlinear matrix differential equations and matrix equations of linear algebra.