INVERSE STATIC OUTPUT FEEDBACK PROBLEM FOR THE FUNCTIONAL INVOLVING CROSS TERMS

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Introduction. Solution of the synthesis static feedback gain problem consists of defining influences the matrix of the on the observable part of the phase vector. Various algorithms are used to the solution of these problems [1-6].

However, in the case of unstable object, for realization of these algorithms it is necessary to have an initial approach, i.e. a matrix of the stabilizing regulator. The choice of this matrix is an independent problem [2, 3] and for its solution various approaches have been offered.

For solution of these problems both the algorithms basing on the linear matrix inequalities [5], and the algorithms demanding calculation of the gradient of objective function [2–4, 6] are used. As well as in [4] the calculation of the objective function and its gradient is reduced to the solution of the Lyapunov equations. For the realization of offered algorithms Matlab package standard procedures (lyap.m, fminu.m) may be used.

Here we formulate the direct and inverse linear stabilizing output regulator syntheses problem. At first we consider the direct problem.

1. Abstract Specifications. Here we formulate the direct and inverse linear stabilizing output regulator syntheses problem. At first we consider the direct problem. Let's consider the linear stationary continuous time system

$$\dot{x}(t) = F(t) + Gu(t); x(0) = x_0 \tag{1}$$

$$y = Cx\,(t) \tag{2}$$

where $x-$ is a state vector of the system, $u-$is a vector controlling action, $y-$ a vector of the output, $F, G, C-$ a constant matrices corresponding dimensions, they are stabilized and observed.

The problem consists in determining of the controlling law with static output feedback

$$u = -Ky \tag{3}$$

providing the asymptotical stability of the system (1)-(3) i.e. satisfying the condition

$$\mathrm{Re}\lambda(F + GKC) < 0 \tag{4}$$

and minimizing the following performance index

$$J = \int_0^\infty (x'Qx + u'Ru + x'Nu)dt \tag{5}$$

Here $Q = Q' \geq 0, R = R' > 0,\ \ N-$ constant matrices with corresponding dimensions.

The solution of the problem (1)-(4) is reduced to the solution of the following nonlinear system of the algebraic equations

$$U(F + GKC)' + (F + GKC)U + X_0 = 0 \tag{6}$$

$$(F+GKC)'S+S(F+GKC)+Q+C'K'RKC+NKC+C'K'N' = 0 \tag{7}$$

$$K = -R^{-1}(G'S + N)UC'(CUC') \tag{8}$$

i.e., solved systems of the nonlinear algebraic equations (6)-(8) the initial matrix K is reconstructed from (8). Inverse problem. Matrices F, G, C, K are given. It is necessary to determine the matrices $Q = Q' \geq 0, R = R' > 0,\ \ N-$ such that the matrix K which is the solution of the problem (6), (8), would coincide with initial. It is necessary to minimize λ in the following LMI

$$\begin{array}{l} S \geq 0, R > 0, \\ (F + GKC)'S + S(F + GKC) + C'K'RKC + NKC + C'K'N \leq 0, \\ MM' < \lambda I; \quad M = G'SUC' + RKCUC' + NUC', \end{array}$$

where U is defined from relation (6). Unknown values of the matrix Q is defined from relation (7).

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