OUTPUT FEEDBACK STABILIZATION OF LINEAR SYSTEMS WITH PARAMETRIC NOISE[1]

Pavel Pakshin **Igor Mitrofanov**
pakshin@afngtu.nnov.ru netspirit@mail.ru

Dept. of Applied Mathematics, Nizhny Novgorod State Technical University at Arzamas, Russia

Consider a linear system described by the following Ito equations:

$$dx(t) = (Ax(t) + Bu(t))dt + \sum_{l=1}^{\nu} A_l x(t) dw_l(t), \quad y(t) = Cx(t) \quad (1)$$

with $t \geq 0$, where $x \in \mathbb{R}^n$ is the state vector, $u \in \mathbb{R}^m$ is the control vector, $y \in \mathbb{R}^k$ is the output vector, $w_l(t)(l = 1, \dots, \nu)$ are standard Wiener processes, which are mutually independent and independent of the initial state of the system.

Define the static output feedback control

$$u(t) = -Gy(t) \quad (2)$$

and the projection matrices on $\mathrm{Im}(C^{\mathrm{T}})$ and $\mathrm{Ker}(C_i)$, respectively:

$$E_{\mathrm{I}} = C^+C, \quad E_{\mathrm{K}} = I - E_{\mathrm{I}},$$

where C^+ is the Moore-Penrose inverse of C.

Theorem 1. *System (1) is mean square stabilizable via output feedback if and only if there exist matrices $M = M^T$, $R = R^T > 0$ and L such that the quadratic matrix equation*

$$A^T H + HA - HBR^{-1}BH + \sum_{j=1}^{\nu} A_j^T H A_j + M = 0$$

has positive-definite solution $H = H^T$ satisfying the matrix inequality

$$(A - BK)^T H + H(A - BK) + \sum_{j=1}^{\nu} A_j^T H A_j - S^T K - K^T S < 0,$$

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where

$$S = LE_I - B^T HE_K, \quad K = R^{-1}B^T H.$$

The corresponding output feedback control has the form (2), where the gain matrix is defined by the formula

$$G = R^{-1}(B^T H + L)C^+. \tag{3}$$

This theorem leads to effective LMI-based algorithm for computing the gain matrix (3) of static output stabilizing control (2). The result is generalized to the case of fixed-order dynamic output feedback. Necessary and sufficient conditions of simultaneous stabilization via output feedback are also obtained.