

the \mathcal{H}_∞ norm of the closed-loop system is bounded by γ for all $\gamma \geq \gamma_{\min}$.

It is well known that the \mathcal{H}_∞ norm of a system is the square root of the largest eigenvalue of the product of the system's Gramians. Therefore, the \mathcal{H}_∞ norm of the closed-loop system is bounded by γ if and only if

$$\lambda_{\max}(P_{\text{cl}} Q_{\text{cl}}) \leq \gamma^2 \quad (10)$$

where P_{cl} and Q_{cl} are the closed-loop Gramians. The closed-loop Gramians are given by

$$P_{\text{cl}} = (A - BK)^{-1} P (A - BK)^{-T} + B K^{-1} B^T \quad (11)$$

and Q_{cl} is the solution of the Lyapunov equation

$$(A - BK) Q_{\text{cl}} (A - BK)^T + B K^{-1} B^T = -Q_{\text{cl}} \quad (12)$$

where P is the solution of the Lyapunov equation

$$A P A^T + B B^T = -P \quad (13)$$

and K is the feedback gain matrix. The feedback gain matrix K is given by

$$K = -B^T P^{-1} A^T \quad (14)$$

where P^{-1} is the inverse of the matrix P . The feedback gain matrix K is given by

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