## Table 9.1 Continued

<table>
<thead>
<tr>
<th>Formula</th>
<th>Continuous-Time</th>
<th>Discrete-Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>The $\mathcal{H}_\infty$ estimation problem</td>
<td>Given the plant $x(t) = Ax(t) + Bu(t) + B_w w(t)$; $m(t) = C_m x(t) + D_{m,w} w(t)$; $y(t) = C_y x(t)$ where $D_{m,w} B_w = 0$; $D_m D_{m,w} = I$, generate an estimator such that $|G_m|_{\infty} &lt; \gamma$.</td>
<td>Given the plant $x(k+1) = \Phi x(k) + \Gamma \nu(k) + \Gamma_w w(k)$; $m(k) = C_m x(k) + D_{m,w} w(k)$; $y(k) = C_y x(k)$ where $D_{m,w} B_w = 0$; $D_m D_{m,w} = I$, generate an estimator such that $|G_m|_{\infty} &lt; \gamma$.</td>
</tr>
<tr>
<td>Existence conditions for a suboptimal estimator</td>
<td>There exists a solution $Q \succeq 0$ of the algebraic Riccati equation $QA + AQ^T - Q(C_m C_m - \gamma^{-2} C_y^T C_y)Q + B_w B_w^T = 0$.</td>
<td>There exists a solution $Q \succeq 0$ of the algebraic Riccati equation $Q = AQA^T - AQ(C_m^T C_m + S^{-1}[C_y^T C_m]) Q A^T + B_w B_w^T$.</td>
</tr>
<tr>
<td>The suboptimal estimator</td>
<td>$\dot{x}(t) = A \dot{x}(t) + B_u u(t) + G { m(t) - C_m x(t) }$ $\dot{y}(t) = C_y x(t)$ $G = QC_m$</td>
<td>$\dot{x}(k+1) = \Phi \dot{x}(k) + \Gamma \nu(k) + G { m(k) - C_m x(k) }$ $\dot{y}(k) = C_y x(k)$ $G = AQC_m + C_m QC_m - 1$ $G_c = C_y QC_m - 1$</td>
</tr>
</tbody>
</table>

1 For discrete-time systems, the signal 2-norm and the system $\infty$-norm are defined as $\|w(k)\|_2 = \left\{ \sum_{k=-\infty}^{\infty} |w(k)|^2 \right\}^{1/2}$ and $\|G\|_\infty = \sup_{w = \mathbb{R}^n} \frac{\|G(k) \otimes w(k)\|_2}{\|w(k)\|_2}$.

## References


Some additional references on $\mathcal{H}_\infty$ control follow:

