Motivation

Team problem – Common objective but different information

Delayed Information Sharing

\[ u^*(t) = \arg\min_{u(t)} \mathbb{E}\left[ \sum_{t=0}^{N-1} (x(t)'Qx(t) + u(t)'Ru(t)) + x(N)'Sx(N) \right] \]

Cost function

\[ H_i(t) = \{ x_i(0 : t - 1), u_i(0 : t - 1) \} \]

Observation history

\[ \mathbf{F}^*(t) \] is optimal gain matrix, obtained as a solution to a deterministic convex optimization problem

\[ K(t) \text{ and } J(t) \text{ are solutions to algebraic Riccati equations} \]

Statistics

\[ x(t) = \mathbb{E}[x(t) | H_1(t), H_2(t)] \]

Sufficient condition for existence of linear optimal control law

\[ \text{Sufficient condition for existence of linear optimal control law} \]

Comparison

<table>
<thead>
<tr>
<th>( d_1 )</th>
<th>( d_2 )</th>
<th>Literature</th>
<th>Comments</th>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Classical LQR</td>
<td>No plant restrictions</td>
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<tr>
<td>1</td>
<td>1</td>
<td>Kurtaran, Sandell, Yoshikawa</td>
<td>No plant restrictions</td>
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<tr>
<td>1</td>
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<td>Lamperski and Doyle</td>
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<td>( \infty )</td>
<td>0</td>
<td>Lall et al.</td>
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<tr>
<td>1</td>
<td>0</td>
<td>Our previous work</td>
<td>No plant restrictions</td>
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Current work: (\( \infty, 1 \))

Future Work

Extended to partial output feedback

Multiple-unit delays

Stochastic games

www.scf.usc.edu/~nnayyar
nnayyar@usc.edu

Presented at Allerton 2013 and submitted to ACC 2014