PE Course: Introduction to Process Control

http://www.cs.aue.auc.dk/~yang/course/2004fall/process04.html
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MM13: State-Space Method - feedback with Estimator

November 15, 2004

1 Reading

- Page 289-299: Estimator design: current estimator, predictor estimator, observability, ...
- Page 302-310: Combination of control law and estimator: separation principle,pole placement, ...
- Page 314-319: Introduce the reference input with estimators...

2 Content

- Observability, ...
- Estimator Design, ...
- Combined Control Law and Estimator, ...
- Introduction of the reference input with estimators, ...

3 Exercise

We continue to consider the system we used in last exercise (MM5 exercise), where the plant is described by a state space model as:

$$\begin{aligned} \dot{X}(t) &= \begin{bmatrix} 7 & -9 \\ 6 & -8 \end{bmatrix} X(t) + \begin{bmatrix} 4 \\ 3 \end{bmatrix} u(t) \\ y(t) &= \begin{bmatrix} 1 & 0 \end{bmatrix} \end{aligned} \tag{1}$$

1. Determine the observability of the considered system; Use Matlab function *ctrb* to confirm your solution;
2. If the closed-loop system's poles are expected to locate at -2 and -1, determine the state feedback gain K, and confirm it using *ltiview* Matlab command (repeat from MM5, you can skip this if you have already done this);
3. Design a full-order estimator such that the eigenvalues of the estimator as 4 and -5;
4. Write out the state space description of the closed-loop system constructed by combining the controller developed in step (2) and the estimator developed in step (3).
5. Introduce the reference input to this controlled system.
6. Write your design into a Matlab file, and check the initial/step response of the closed loop system using command **initial()/step()**.