EE 105 Feedback control systems

Control in state space: all together now

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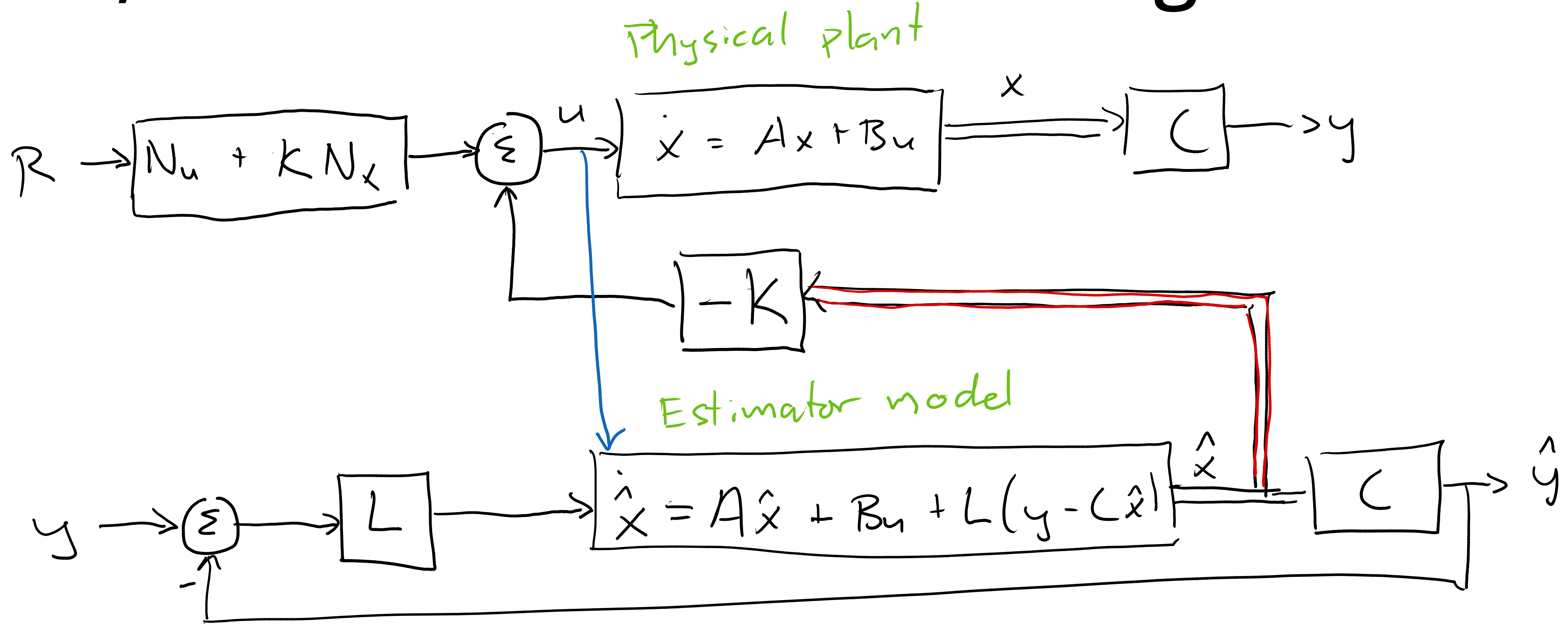
Wait, is that combined matrix right?



$$\begin{bmatrix}\dot{x}\\ \dot{\hat{x}}\end{bmatrix} = \begin{bmatrix} A \cancel{-BK} & 0 - BK \\ LC \cancel{-BK} & A - LC - BK\end{bmatrix}\begin{bmatrix}x\\ \hat{x}\end{bmatrix}$$

$$\hat{y} = \begin{bmatrix} 0 & C \end{bmatrix}\begin{bmatrix}x\\ \hat{x}\end{bmatrix}$$

Does this change the behavior?

Start with the pendulum system from last class

1) Implement a full-state controller (just K, no estimator)

   Put the poles wherever you'd like

2) Implement an estimator, and use this to drive the controller

   Put the estimator poles wherever you'd like

3) Compare the behavior

   Where are the poles of the combined system?

   What does the time-domain response (initial) look like?

Adding the reference input back

Thinking about digital control...

What issues do we need to consider?

speed → sample rate

speed → delay

quantization → quantization noise

numerical limits / data types

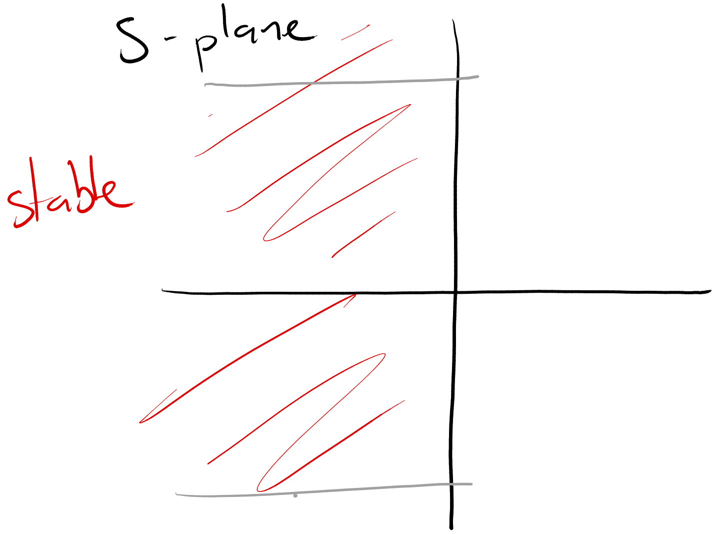
memory

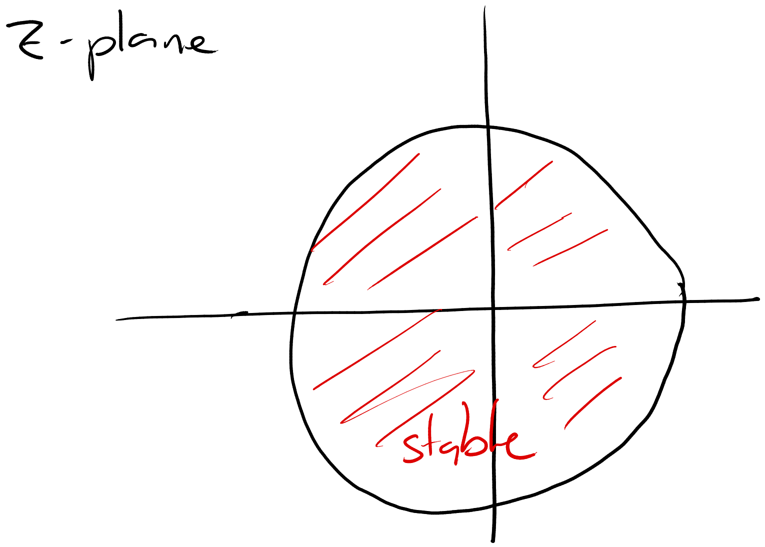
rounding – float precision

what are we controlling

Thinking about digital control...

What issues do we need to consider?





$$\dot{x} = Ax$$

$$x_{k+1} = Ax_k$$