Wellposedness of Linear Control Systems

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We consider linear control systems with unbounded control and output operators and investigate well-posedness with a semigroup approach.

On the Banach spaces $X, U, Y$, called state, control and output space, we consider the following linear operators.

- $A : D(A) \subset X \to X$, generator of a $C_0$-semigroup, the state operator,
- $B \in \mathcal{L}(U, X_{-1})$ the control operator,
- $C \in \mathcal{L}(X_1, Y)$ the output operator,
- $D \in \mathcal{L}(U, Y)$ the feedthrough operator.

With these operators we introduce the following linear control system

$$
\Sigma(A, B, C, D) : \begin{cases}
\dot{x}(t) = Ax(t) + Bu(t), & t \geq 0, \\
y(t) = Cx(t) + Du(t), & t \geq 0.
\end{cases}
$$

We construct an operator matrix $A$ on an appropriate product space $\mathcal{X}$ and define the system $\Sigma(A, B, C, D)$ to be well-posed if $A$ generates a strongly continuous semigroup on $X$.

The generator property of $A$ can be characterized by means of certain properties “admissibility” of the operators $B, C$.

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$^1$ $X_{-1}$ is the extrapolation space of $X$ w.r.t. $A$.

$^2$ $X_1$ denote $D(A)$ endowed with the graph norm induced by $A$. 