

**Definition** (Discrete-time linear systems). A discrete-time linear time-invariant proper open system is defined by three matrices **A**, **B**, **C**. Together they give a recurrence of the type

$$\begin{aligned}\mathbf{x}_{k+1} &= \mathbf{A}\mathbf{x}_k + \mathbf{B}\mathbf{u}_k \\ \mathbf{y}_k &= \mathbf{C}\mathbf{x}_k\end{aligned}$$

If  $\mathbf{x}$  has dimension  $n \geq 1$ ,  $u$  dimension  $m \geq 1$  and  $\mathbf{y}$  dimension  $p \geq 1$ , then **A** has dimension  $n \times n$ , **B** has dimension  $n \times m$ , and **C** has dimension  $p \times n$ .