Notation used in the lectures

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Data $\mathscr{D}$

- static case: $\mathscr{D} = \{ d_1, \dots, d_N \}, \quad d_i \in \mathbb{R}^q$
- dynamic case: $$w = \{ w^1, \dots, w^N \}$$ $$w^i = \big(w^i(1), \dots, w^i(T_i)\big) \in (\mathbb{R}^q)^{T_i}$$
- dimensions:

q	—	# of variables
N	—	# of experiments
T	—	# of time samples

Data matrices

D	$=$	$\begin{bmatrix} d_1 & \cdots & d_N \end{bmatrix}$ (unstructured)
$\mathscr{H}_L(w)$	—	Hankel with L block rows
$\mathscr{M}_T(R)$	—	multiplication matrix with T block col.

Signal modifiers

w	—	general trajectory
w_{d}	—	measured trajectory
$\widehat{w}$	—	approximation
$\overline{w}$	—	true value
w_T	—	restriction to $[1, T]$
σw	—	shift $(\sigma w)(t) := w(t+1)$
$w_{\mathrm{p}} \wedge w_{\mathrm{f}}$	—	concatenation of w_{p} and w_{f}

Model class $\mathscr{M}$

- $\mathscr{L}^{q}_{\mathtt{m},\ell}$ — LTI models with q var., $\leq \mathtt{m}$ inputs, lag $\leq \ell$
- dimensions:

$\mathtt{m}$ / p	—	# of inputs / outputs
n / ℓ	—	order / lag

LTI model representations

$\ker(R)$	—	kernel
$\text{image}(P)$	—	image
$\mathscr{B}(A,B,C,D,\Pi)$	—	input/state/output

LTI model properties

linearity	$w,v \in \mathscr{B} \implies \alpha w + \beta v \in \mathscr{B},\ \forall\ \alpha,\beta$
time-invariance	$\sigma^\tau \mathscr{B} = \mathscr{B}$, for all $\tau \in \mathscr{T}$
finite dimension	the lag of $\mathscr{B}$ is finite
autonomy	past determines future
controllability	past and future can be concatenated