1. Abstract Dynamical System → (ADS)

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$S = \{T, W, \Sigma\}$ generalization of the concept of mathematical model

Σ = set of variables of all the possible behaviors

T: time set ($\mathbb{R}$ continuous, $\mathbb{Z}$ discrete)

W: set of values of the variables

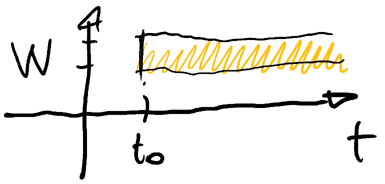
→ $\Sigma = \{\Sigma(t_0) \subset W^{T(t_0)} : t_0 \in T \ni \text{CRT holds}\}$

CRT ↓ closure respective truncation

$T(t_0) = \{t \in T : t \geq t_0\}$

$W^{T(t_0)} = \{W_0(\cdot) : \forall t \in T(t_0) \quad w(t) \in W$

→ the set of all the functions which are defined in $T(t_0)$ and assume value in W



CRT: $W_0 \in \Sigma(t_0) \Rightarrow \forall t_1 \geq t_0 \quad w_0|_{T(t_1)} \in \Sigma(t_1)$

PROPERTIES

- Uniform ADS

$\forall W_1 \in \Sigma(t_1) \; \exists \; W_0 : W_1 = W_0|_{T(t_1)} \; \forall t_0 \leq t_1$

→ CRT & uniformity implies that

$\Sigma_{UN} \subset W^T$

(UN → uniform)

- Linear ADS

$\Sigma(t_0)$ is linear $\forall t_0 \in T$ if

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$R_1 W_0^1 + R_2 W_0^2 \in \Sigma(t_0)$

- Stationary ADS

defined the operator of translation $\Delta_{\bar{t}} f(t) = f(t-\bar{t})$
the system is stationary if
$\Delta_{t_1} \Sigma(t_0) = \Sigma(t_0 + t_1) \longrightarrow \Sigma(t_0) = \Delta_{t_0} \Sigma(0)$

DS with auxiliary variables

$S_a = \{T, W, A, \Sigma_a\}$ representation with auxiliary variables of S if:

A = set of auxiliary variables

$\Sigma_a = \{\Sigma_a(t_0) \subset (W \times A)^{T(t_0)}, t_0 \in T \ni c R T\}$

$\forall t_0 \quad \Sigma(t_0) = \{W_0 : \exists a_0 \in A^{T(t_0)} : (W_0, a_0) \in \Sigma_a(t_0)\}$