This is a testfile for vscode

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摘要

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First, we present a lemma on the Lyapunov function: . Let a system $\dot{x}(t) = f(x(t), x(t-h(t)))$ with $f(0,0) = 0$. Assume the Lyapunov function $F : G \to \mathbb{R}$ exists with $x, y \in G$, $F(y) < F(x)$ implies

$$\left(\dot{F}(x) f(x,y)\right)\left(\ddot{F}(x) f(x,y)\right) \leq 0. \tag{1}$$

Then the solution $x(t) \equiv 0$ is stable.

Suppose there exists a Lyapunov function $F : \mathbb{R}^n \to \mathbb{R}$. Then define functional $V : \mathcal{C} \to \mathbb{R}$ as follows:

$$V(\phi) := \max_{-h \leq \theta \leq 0} F(\phi(\theta)), (\forall \phi \in \mathcal{C}). \tag{2}$$

By definition, the following conditions hold:

$$\dot{V}(\phi) \begin{cases} \leq 0, & \text{if } F(\phi(0)) < V(\phi), \\ = \max\left(\dot{F}(\phi(0)), f(\phi(0), \phi(-h(t))), 0\right), & \text{if } F(\phi(0)) = V(\phi), \end{cases} \tag{3}$$

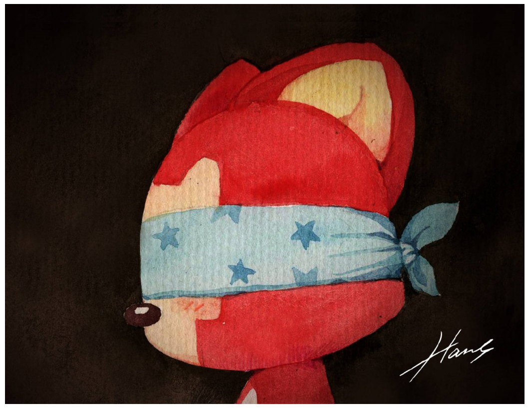
where $f(\phi(0), \phi(-h(t))) = \Psi\phi(0) + \Psi_d \phi(-h(t))$.

Thus $\dot{V}(\phi) > 0$ holds if and only if the following condition holds:

$$F(\phi(0)) = \max_{-h \leq \theta \leq 0} F(\phi(\theta)) \ and (\dot{F}(\phi(0)), f(\phi(0), \phi(-h(t)))) > 0. \tag{4}$$

The function F can be defined in some neighborhood $G \subset \mathbb{R}^n$. Moreover, the functional V is then defined for $\phi \in \mathcal{C}$ with values in G.

Suppose Equation (**??**) holds for some functions $\phi \in \mathcal{C}$, then we can obtain the inequality $F(\phi(-h(t))) < F(\phi(0))$ making ϕ arbitrarily small. Thus the second condition in Equation (**??**) still holds but conflicts with Lemma **??**. Therefore $\dot{V}(\phi) \leq 0$ holds constantly for all ϕ.



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