Université Alioune DIOP de Bambey

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On the Barabanov Norms by Moussa GAYE

Abstract : Consider the class of continuous-time linear differential equations of the form

$$\dot{x}(t) = A(t)x(t), \tag{1}$$

where the state x belongs to $\mathbb{R}^n$ and the switching law $A(\cdot)$ is any measurable function taking values on a compact and convex set $\mathcal{M}$ of $\mathbb{R}^{n\times n}$ (the set of $n \times n$ real matrices). Associated with $\mathcal{M}$, we define the largest Lyapunov exponent as follows :

$$\rho(\mathcal{M}) := \sup_{x(\cdot):x(0)\neq 0} \left(\limsup_{t\to+\infty} \frac{1}{t} \log \|x(t)\| \right).$$

Once Eq. (1) is irreducible and the largest Lyapunov exponent is equal to zero, there exists on $\mathbb{R}^n$ a decreasing norm $v(\cdot)$ along trajectories of Eq. (1), and, starting from $x_0 \in \mathbb{R}^n$ there exists a trajectory (called extremal solution) along which $v(\cdot)$ is constant. Such a norm is called a Barabanov norm.

In this talk, we first analyze some geometric properties of Barabanov norms. Next, we study the asymptotic behavior of the extremal solutions of Eq. (1). In the last part, we list some open questions related to the Barabanov norms.

Keywords : Largest Lyapunov exponent, Barabanov norms, extremal solutions ...