Mathematics > Dynamical Systems

Extremal ergodic measures and the finiteness property of matrix semigroups

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Let $\bS=\{S_1,...,S_K\}$ be a finite set of complex $d\times d$ matrices and $\varSigma_{K}^+$ the compact space of all one-sided infinite sequences $i_{\bcdot}\colon\mathbb{N}\rightarrow\{1,...,K\}$. An ergodic probability μ_* of the Markov shift $\theta\colon\varSigma_{K}^+;\rightarrow\varSigma_{K}^+;\ i_{\bcdot}\mapsto i_{\bcdot+1}$, is called "extremal" for $\bS$, if ${\rho}(\bS)=\lim_{n\to\infty}\sqrt[n]{\norm{S_{i_1}...S_{i_n}}}$ holds for μ_*-a.e. $i_{\bcdot}\in\varSigma_{K}^+$, where $\rho(\bS)$ denotes the generalized/joint spectral radius of $\bS$. Using extremal norm and Kingman subadditive ergodic theorem, it is shown that $\bS$ has the spectral finiteness property (i.e. $\rho(\bS)=\sqrt[n]{\rho(S_{i_1}...S_{i_n})}$ for some finite-length word $(i_1,...,i_n)$) if and only if for some extremal measure μ_* of $\bS$, it has at least one periodic density point $i_{\bcdot}\in\varSigma_{K}^+$.

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