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Semigroups and Moment Lyapunov Exponents

Let G be a noncompact semi-simple Lie group with finite center and μ a probability measure on G. We consider (i) the semigroup S_μ generated by the support of μ (with the assumption that $\mathrm{int} S_\mu \neq \emptyset$); (ii) The spectral radii r_λ of the operators $U_\lambda(\mu)$ where U_λ is a (nonunitary) representation of G induced by a real character and (iii) the moment Lyapunov exponents $\gamma(\lambda, x)$ of the i.i.d. random product on G defined by μ. The equality $r_\lambda = \gamma(\lambda, x)$ holds in many cases. We give a necessary and sufficient condition to have $S_\mu = G$ in terms of the analyticity of the map $\lambda \mapsto r_\lambda$. The condition is applied to measures obtained by solutions of invariant stochastic differential equations on G yielding a necessary and sufficient condition for the controllability of invariant control systems on G in terms of the largest eigenvalues of second order differential operators.