On the Stochastic Stability of Limiting Measures in SODEs

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Abstract. We exploit limiting measures of stationary measures of stochastic ordinary differential equations. Such measures are more stable than other invariant measures of unperturbed systems or the most stable if they uniquely exist to stochastic perturbations. Using the Freidlin-Wentzell large deviations principle, we prove that limiting measures are concentrated away from repellers which are topologically transitive, or equivalent classes, or admit Lebesgue measure zero. We also preclude concentrations of limiting measures on acyclic saddle or trap chains and prove that limiting measures are concentrated on minimal elements of the partial order induced by the Freidlin-Wentzell's equivalent relation, which are Liapunov stable if there are a finite number of equivalent classes. Applications are made to the Morse-Smale systems, the Axiom A systems including structural stability systems and separated start systems, the gradient or gradient-like systems, those systems possessing a finite number of limit sets to obtain that limiting measures live on Liapunov stable critical elements, Liapunov stable basic sets, Liapunov stable equilibria, Liapunov stable limit sets including saddle or trap cycles, respectively. A number of nontrivial examples admitting a unique limiting measure are provided, which include monostable and multistable systems. This is a joint work with Xu Tianyuan and Chen Lifeng.