



Slow Manifolds for Multi-Time-Scale Stochastic Evolutionary Systems

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This article deals with invariant manifolds for infinite dimensional random dynamical systems with different time scales. Such a random system is generated by a coupled system of fast-slow stochastic evolutionary equations. Under suitable conditions, it is proved that an exponentially tracking random invariant manifold exists, eliminating the fast motion for this coupled system. It is further shown that if the scaling parameter tends to zero, the invariant manifold tends to a slow manifold which captures long time dynamics. As examples the results are applied to a few systems of coupled parabolic-hyperbolic partial differential equations, coupled parabolic partial differential-ordinary differential equations, and coupled hyperbolic-hyperbolic partial differential equations.

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