Averaging of attractors and inertial manifolds for parabolic PDE differential equation with random coefficients*

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Abstract

The averaging method has been used to study random or non-autonomous systems on a fast time scale. We apply this method to a random abstract evolution equation on a fast time scale whose long-time behavior can be characterized by a random attractor or a random inertial manifold. The main purpose is to show that the long-time behavior of such a system can be described by a deterministic evolution equation with averaged coefficients. Our first result provides an averaging result on finite time intervals which we use to show that under a dissipativity assumption the attractors of the fast time scale systems are upper semi-continuous when the scaling parameter goes to zero. Our main result deals with a global averaging procedure. Under some spectral gap condition we show that inertial manifolds of the fast time scale system tend to an inertial manifold of the averaged system when the scaling parameter goes to zero. These general results are applied to semilinear parabolic differential equations containing a scaled ergodic noise on a fast time scale which includes scaled almost periodic motions.

*oral communication.