Statistical inference for Stochastic PDEs

Randolf Altmeyer
(Imperial College London)

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12489 Berlin
Room 1.115

Abstract

Many naturally occurring phenomena in Physics, Biology and Engineering are best described by Stochastic partial differential equations (SPDEs). Such models correspond to PDEs with random forcing terms and differ qualitatively from PDEs observed with measurement noise. To validate SPDE models on real data, we need to estimate relevant model parameters and quantify our uncertainty about these estimates. In this talk, we will motivate such statistical questions for a concrete PDE example from Systems Biology, and then discuss more generally how we can estimate the diffusivity function in a stochastic heat equation.

In contrast to classical statistics for stochastic ODEs, the spatial nature of SPDEs creates new challenges, but also allows for learning about the data from information in time and space simultaneously. We will discuss the consequences for finding optimal and efficient estimators, and how this is related to the reproducing kernel Hilbert space of the underlying process as well as to stochastic filtering.

*Punctual, i.e. sine tempore!