

Title: Stochastic Differential Equations with Gaussian Noise

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Abstract: Stochastic partial differential equations of second order with two unknown parameters are studied. The strongly continuous semigroup  $(S(t), t \geq 0)$  for the hyperbolic system driven by Brownian motion is found as well as the formula for the covariance operator of the invariant measure  $Q_\infty^{(a,b)}$ . Based on ergodicity, two suitable families of minimum contrast estimators are introduced and their strong consistency and asymptotic normality are proved. Moreover, another concept of estimation using "observation window" is studied, which leads to more families of strongly consistent estimators. Their properties and special cases are described as well as their asymptotic normality. The results are applied to the stochastic wave equation perturbed by Brownian noise and illustrated by several numerical simulations.

Keywords: Stochastic hyperbolic equation, Ornstein–Uhlenbeck process, invariant measure, parameter estimation, strong consistency, asymptotic normality.