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# Random-field Solutions to Linear Hyperbolic Stochastic Partial Differential Equations with Variable Coefficients*

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**Abstract**

In this article we show the existence of a random-field solution to linear stochastic partial differential equations whose partial differential operator is hyperbolic and has variable coefficients that may depend on the temporal and spatial argument. The main tools for this, pseudo-differential and Fourier integral operators, come from microlocal analysis. The equations that we treat are second-order and higher-order strictly hyperbolic, and second-order weakly hyperbolic with uniformly bounded coefficients in space. For the latter one we show that a stronger assumption on the correlation measure of the random noise might be needed. Moreover, we show that the well-known case of the stochastic wave equation can be embedded into the theory presented in this article.

**2010 Mathematics Subject Classification:** Primary: 35L10, 60H15; Secondary: 35L40, 35S30

**Keywords:** stochastic partial differential equations, stochastic wave equation, hyperbolic partial differential equations, fundamental solution, variable coefficients, Fourier integral operators

## 1 Introduction

In the recent years there has been a huge progress in the solution theory to stochastic partial differential equations (SPDEs). A linear SPDE is given by the following equation

$$Lu(t,x) = \gamma(t,x) + \sigma(t,x)\dot{F}(t,x), \tag{1.1}$$

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