METHOD OF LINES FOR HYPERBOLIC STOCHASTIC FUNCTIONAL PARTIAL DIFFERENTIAL EQUATIONS

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We consider the initial value problem for first-order stochastic functional partial differential equation driven by Brownian motion

$$\begin{aligned} \frac{\partial u}{\partial t}(t,x) + a(t,x)\frac{\partial u}{\partial x}(t,x) &= f(t,x,u_{(t,x)}) + g(t,u_{(t,0)})\dot{W}_t, \quad (t,x) \in [0,T]\times\mathbb{R} \\ u(t,x) &= \varphi(t,x), \quad (t,x) \in [-r,0]\times\mathbb{R}, \end{aligned}$$

where $\dot{W}_t$ is white noise and $u_{(t,x)}$ is a Hale-type operator

$$u_{(t,x)}(\tau,\theta) = u(t+\tau, x+\theta) \quad for \quad (\tau,\theta) \in [-r,0]\times\mathbb{R}.$$

We apply the method of lines and prove the stability of the numerical scheme. This result is proved with the help of representation, existence and uniqueness, and the estimation of solution lemmas.