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APPROXIMATE CONTROLLABILITY OF SECOND-ORDER NEUTRAL STOCHASTIC EVOLUTION EQUATIONS

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Abstract. Approximate controllability results are established for a class of abstract second-order neutral stochastic evolution equations in a real separable Hilbert space. Applications to stochastic equations are provided to illustrate the abstract theory.
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1 Introduction

The focus of this investigation is the approximate controllability problem for the class of abstract neutral semi-linear stochastic evolution equations of the form

$$d\left[x'(t)-f_1\left(t,x(t)\right)\right]=\left[Ax(t)+Bu(t)+f_2\left(t,x(t)\right)\right]dt+g\left(t,x(t)\right)dW(t),$$
$$x(0)=\xi,\;\; x'(0)=\varsigma,\;\; 0\leq t\leq T, \tag{1}$$

in a real separable Hilbert space H, where the linear (possibly multi-valued) operator $A:D(A)\subset H\to H$ is the infinitesimal generator of a strongly continuous cosine family on H; W is a K-valued Wiener process with incremental covariance given by the nuclear operator Q defined on a complete probability space $(\Omega,\Im,P)$ equipped with a normal filtration $(\Im_t)_{t\geq 0}$; $f_i:[0,T]\times H\to H$ $(i=1,2)$ and $g:[0,T]\times H\to L_2\left(Q^{1/2}K;H\right)$ (where K is another real separable Hilbert space and $L_2\left(Q^{1/2}K;H\right)$ will be defined later) are appropriate mappings; $B:U\to H$ is a given mapping; u is an appropriate control function; and ξ and ς are $\Im_0$-measurable H-valued random variables independent of W.

Stochastic partial differential equations (SPDEs) arise naturally in the mathematical modeling of various phenomena in the natural and social sciences [28], [29], [32]. The qualitative properties (existence, stability, controllability, invariant measures, etc.) for first-order semilinear SPDEs have received much attention (see [3], [4], [20], [21], [22], [13] and references therein).