Weak convergence for a stochastic exponential integrator and finite element discretization of SPDE for multiplicative and additive noise

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We consider a finite element approximation of a general semi-linear stochastic partial differential equation (SPDE) driven by space-time multiplicative and additive noise. We examine the weak convergence of an exponential integrator in the case where the linear operator is not necessarily self adjoint. As usual we found that the rate of weak convergence is twice the strong rate of convergence. Our convergence result is in agreement with some numerical results presented for a linear diffusion equation in two dimensions as well as a nonlinear example of a two-dimensional stochastic advection diffusion reaction equation motivated from realistic porous media flow.