THE NEWTON METHOD FOR STOCHASTIC FUNCTIONAL DIFFERENTIAL EQUATIONS

MONIKA WRZOSEK

The convergence of the Newton method for stochastic differential equations was proved by Kawabata and Yamada [3]. In [1] Amano formulates equivalent problem and gives a direct way to estimate the approximation error. In [2] he proposes a probabilistic second-order error estimate. Our goal is to obtain similar results in the case of stochastic functional differential equations:

$$\begin{cases} dX_t &= b(t, X_{t+\cdot})dt + \sigma(t, X_{t+\cdot})dB_t \text{ for } t \in [0,T] \\ X_t &= \varphi_t \text{ for } t \in [-\tau, 0], \end{cases}$$

where $X_{t+\cdot}$ is the $L^2(\Omega)$-valued Hale-type operator.

The existence and uniqueness of solutions to stochastic functional differential equations has been discussed in a large number of papers ([4]). The first part of the present paper deals with the first-order convergence. We formulate a Gronwall type inequality which plays an important role in the proof of the convergence theorem. In the second part the probabilistic second-order convergence is considered.

References

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[4] Turo J.; *Study to a class of stochastic functional-differential equations using integral contractors*, Functional Differential Equations, Vol.6 (1999), No.1-2, pp. 177 - 189.