**RUNGE-KUTTA SCHEME FOR STOCHASTIC OPTIMAL CONTROL PROBLEMS**

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In this study, we analyze Runge-Kutta scheme for the numerical solutions of stochastic optimal control problems by using discretize-then-optimize approach. Firstly, we discretize the cost functional and the state equation with the help of Runge-Kutta schemes. Then, we state the discrete Lagrangian and take the partial derivative of it with respect to its variables to get the discrete optimality system. By comparing the continuous and discrete optimality conditions, we find a relationship between the Runge-Kutta coefficients of the state and adjoint equation, so that we present Runge-Kutta scheme for the adjoint pair (p(t),q(t)). Similar to the deterministic setting, the issue of convergence is important when dealing with a numerical scheme. In stochastic case, this can be achieved either by using the strong-order convergence or weak-order convergence criteria. In this study, we emphasize the strong convergence criteria. We match the stochastic Taylor expansion on the exact solution of continuous optimality system with the stochastic Taylor expansion of approximate solution of our discrete optimality system, term by term, in order to get both strong-order conditions. Finally, we confirm our results with some numerical examples from the financial sector. We compare our numerical results with Euler method and exact solution to demonstrate the efficiency of our Runge-Kutta method.