

Upcoming Operations Research Ph.D. Prelim Exam Yipeng Yang

Path Dependent Stochastic Models and Their Applications in
Finance and Communications

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Abstract:

Stochastic models play an important role in finance and wireless communications. Recently, the path dependent stochastic models are becoming more important and popular. In this paper, we will consider several path dependent stochastic models.

In financial markets, a short term performance of a stock will affect the motivation of the buyers and the sellers, and in turn, these actions will have impact on the stock price. For this kind of problem, we propose a stochastic portfolio optimization model with memory. We will derive the Hamilton-Jacobi-Bellman equation for the value function and analyze the effect of the memory.

In wireless communications, information delay is a well known issue. Therefore, it is appropriate to use stochastic models with delay, i.e., path dependent stochastic models. While the HJB equation for the value function is difficult to solve explicitly, numerical computations can be applied. We will use the controlled Markov Chain approximation to solve this kind of problem and the optimal stochastic control strategy will be derived.

For some strong path dependent models, like pricing mortgage backed securities (MBS), the Markovian approximation is hard to apply. In this case, the Monte Carlo simulation is broadly implemented. The fundamental point of this method is the random number generating. Therefore, the performance of different random number generating methods in pricing MBS is an interesting issue. It is known that the absolute convergence of this pricing problem is slow. Here we presented a two step pricing procedure and found that it is very efficient in reducing the computation burden.