

## **Existence of an optimal control for stochastic control systems with nonlinear cost functional**

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### **Abstract**

We consider a stochastic control problem which is composed of a controlled stochastic differential equation and whose associated cost functional is defined through a controlled backward stochastic differential equation. Under appropriate convexity assumptions on the coefficients of the forward and the backward equations, we prove the existence of an optimal control on a suitable reference stochastic system. The proof is based on an approximation of the stochastic control problem by a sequence of control problems with smooth coefficients, admitting an optimal feedback control. The quadruplet formed by this optimal feedback control and the associated solution of the forward and the backward equations are shown to converge in law, at least along a subsequence. The convexity assumptions on the coefficients then allow to construct from this limit an admissible control process which, on an appropriate reference stochastic system, is optimal for our stochastic control problem.

**Keywords :** backward stochastic differential equations, stochastic control systems, optimal control

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