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**Linear Stochastic Control  
with Quadratic and Exponential Quadratic Cost  
and State and Control Dependent Noise**

A control problem for a linear stochastic system with stochastic coefficients, linear state and control dependent noise, and a quadratic cost functional is formulated and solved. A stochastic Riccati equation is described that is used to obtain an explicit optimal control in a direct way using the Doob–Meyer decomposition of a sub-martingale for the running cost. In addition an explicit optimal control for the discrete time linear exponential quadratic Gaussian control problem is obtained which does not use traditional methods of dynamic programming or stochastic maximum principle. The method to obtain the explicit optimal control and optimal cost is algebraic. This approach provides some insight into the terms that occur in the Riccati difference equation that determines the optimal feedback control.