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Least Squares Solution for Linear Quadratic Gaussian Problem with Stochastic Approximation Approach

Authors : Sie Long Kek, Wah June Leong, Kok Lay Teo

Abstract : Linear quadratic Gaussian model is a standard mathematical model for the stochastic optimal control problem. The combination of the linear quadratic estimation and the linear quadratic regulator allows the state estimation and the optimal control policy to be designed separately. This is known as the separation principle. In this paper, an efficient computational method is proposed to solve the linear quadratic Gaussian problem. In our approach, the Hamiltonian function is defined, and the necessary conditions are derived. In addition to this, the output error is defined and the least-square optimization problem is introduced. By determining the first-order necessary condition, the gradient of the sum squares of output error is established. On this point of view, the stochastic approximation approach is employed such that the optimal control policy is updated. Within a given tolerance, the iteration procedure would be stopped and the optimal solution of the linear-quadratic Gaussian problem is obtained. For illustration, an example of the linear-quadratic Gaussian problem is studied. The result shows the efficiency of the approach proposed. In conclusion, the applicability of the approach proposed for solving the linear quadratic Gaussian problem is highly demonstrated.

Keywords : iteration procedure, least squares solution, linear quadratic Gaussian, output error, stochastic approximation
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