

The traditional difficulty with stochastic singular control is characterizing the regularities of the value function and the optimal control policy. In this paper, a multidimensional singular control problem is considered. We found the optimal value function and the optimal control policy of this problem via a Dynkin game, whose solution is given by the saddle point of the cost function. The existence and uniqueness of the solution to this Dynkin game are proved through an associated variational inequality problem involving Dirichlet form. As a consequence, the properties of the value function of this Dynkin game imply the smoothness of the value function of the stochastic singular control problem. In this way, we are able to show the existence of a classical solution to this multidimensional singular control problem, which was traditionally solved in the sense of viscosity solutions, and this enables the application of the verification theorem to prove optimality.

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