

Matrix Riccati BSDEs with Singular Terminal Condition and Stochastic LQ Control with Linear Terminal Constraint

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Abstract

We analyze a class of multidimensional linear-quadratic stochastic control problems with random coefficients, motivated by multi-asset optimal trade execution. The problems feature non-diffusive controlled state dynamics and a terminal constraint that restricts the terminal state to a prescribed random linear subspace. We derive the associated Riccati backward stochastic differential equation (BSDE) and identify a suitable formalization of its singular terminal condition. Via a penalization approach, we establish existence of a minimal supersolution of the Riccati BSDE and use it to characterize both the value function and the optimal control. We analyze the asymptotic behavior of the supersolution near terminal time and discuss special cases where closed-form solutions can be obtained.