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12. Probability and Statistics

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Optimality for the stochastic linear-quadratic regulator

We consider a linear-quadratic regulator disturbed by a white noise with time dependent coefficients and the horizon T tending to infinity. It is well known (see [1]) that under natural conditions there exists the linear feedback control $\widehat{u}$ which is optimal in deterministic case for $T = \infty$. Consider $\Delta_T(u) = J_T(\widehat{u}) - J_T(u)$, where $J_T(u)$ is the random variable corresponding to the value of functional under admissible (adaptive) control u. Traditional result states that $\lim_{T\to\infty} E(\Delta_T(u)/T) \leq 0$ for any admissible u. We show that $\limsup_{T\to\infty} \Delta_T(u)/\ln T < c_1$ a. s. for any admissible u, and construct u^* such that $\limsup_{T\to\infty} \Delta_T(u^*)/\ln T > c_2 > 0$ a. s. Preliminary result was obtained in [2], u^* was constructed in [3], general case is proved by T. Belkina, Yu. Kabanov, E. Presman (under preparation).

References: [1] H. Kwakernaak, R. Sivan, *Linear optimal control systems*, Wiley-Interscience, 1972; [2] E. Presman, *Theory of probability and its applications*, **42** (1997), n.3; [3] S. Nagaev, E. Presman, *Theory of probability and its applications*, **43** (1998), n.2.