报告九

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Expensive Control for Networked Systems with Random Delay

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摘要: In this paper, we study the long-time average cost control for discrete-time networked linear feedback system, where the control effort is assumed to be expensive in the mean-square sense. The control signal is transmitted over an unreliable channel with random integer-step delays and packet dropout, which are modeled by an independent and identically distributed (i.i.d.) stochastic process with a certain probability mass function (PMF). It is assumed that the transmitted signal are with time stamps and allowed to be received at the same sampling time simultaneously if possible. At the channel terminal, a linear combination of the received data is applied as an input signal of the plant under the zero-input strategy. The controller design approach is based on a mean-square small gain theorem dominated by a so called frequency signal-to-noise ratio of the channel uncertainty and a mean complementary sensitivity function of the system. When the state feedback is taken into consideration, it is shown that the optimal performance can be achieved by using a static state feedback law of the plant with employing a linear autoregressive encoder to the resulting signals to be transmitted. The state feedback law and the encoder parameters can be gained by solving a discrete algebraic Riccati-type equation (DARE). A necessary and sufficient condition for the existence of the stabilizing solution of the DARE is presented. We also generalized the expensive control problem from state feedback to output feedback under the plant being constricted to be minimum phase. For this case, the optimal controller design also amounts to solving an DARE and a separation principle holds.

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