On the stabilizing solution of the Riccati equation arising in connection with discrete-time stochastic zero sum LQ dynamic games with periodic coefficients

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We consider the discrete-time stochastic zero sum LQ dynamic games with periodic coefficients. First, we point out the role of the stabilizing solution of the equation:

$$X(t) = \sum_{j=0}^{r} A_j^T(t)X(t+1)A_j(t) - [\sum_{j=0}^{r} A_j^T(t)X(t+1)B_j(t) + L(t)] \quad (1)$$

$$\times \left[R(t) + \sum_{j=0}^{r} B_j^T(t)X(t+1)B_j(t) \right]^{-1} [\sum_{j=0}^{r} B_j^T(t)X(t+1)A_j(t) + L^T(t)] + M(t),$$

$t \in \mathbb{Z}$, satisfying the sign conditions

$$\begin{array}{l} (I_{m_1} \quad 0)\,(R(t) + \sum_{j=0}^{r} B_j^T(t)X(t+1)B_j)\,(I_{m_1} \quad 0)^T < 0\,, \\ (0 \quad I_{m_2})\,(R(t) + \sum_{j=0}^{r} B_j^T(t)X(t+1)B_{j2})\,(0 \quad I_{m_2})^T > 0\,, \end{array} \quad (2)$$

in derivation of the equilibrium strategy for the considered game.

In addition, an iterative method for numerical computation of the stabilizing and periodic solution of equation (1) satisfying the sign conditions (2) is presented. The performance of the proposed method is illustrated on a numerical example. For the deterministic case (i.e. $r = 0$) a part of the results presented here may be found in [1, 2].

References

[1] V. Dragan, S. Aberkane, I. Ivanov, On computing the stabilizing solution of a class of discrete-time periodic Riccati equations. *Int. J. Robust Nonlinear Control*, 25, 2015, 1066–1093.

[2] V. Dragan, S. Aberkane, I. Ivanov, An iterative procedure for computing the stabilizing solution of discrete-time periodic Riccati equations with an indenite sign, *Proceedings of the 21-st International Symposium on Mathematical Theory of Networks and Systems,* July 7-11, 2014, Groningen, The Netherlands, 176–183.