On the Asymptotic Structure of the Stabilizing Solution of the Riccati Equation Arising in Connection with the Linear Quadratic Regulator Problem for a System Described by Itô Differential Equations with Two Fast Time Scales

V. Drăgan[1], I.-L. Popa[2], S. Aberkane[3,4]

[1]*Institute of Mathematics "Simion Stoilow" of the Romanian Academy*
P.O.Box 1-764, RO-014700, Bucharest, Romania
and The Academy of the Romanian Scientists
[2]*Department of Exact Sciences and Engineering,*
"1 Decembrie 1918" University of Alba Iulia, Alba Iulia, 510009, Romania
[3]*Université de Lorraine, CRAN, UMR 7039, Campus Sciences,*
BP 70239 Vandoeuvre-les-Nancy Cedex, 54506, France
[4]*CNRS, CRAN, UMR 7039, France*
e-mail: `Vasile.Dragan@imar.ro`

We consider a stochastic optimal control problem described by a quadratic performance criterion and a linear controlled system modeled by a system of singularly perturbed Itô differential equations with two fast time scales.

Our goal is to analyse the asymptotic structure with respect to the small parameters $\varepsilon_j > 0, j = 1, 2$ associated to the two fast time scales of the stabilizing solution of the matrix Riccati equation associated to the optimal control problem under consideration. The results derived in this stochastic framework cannot be obtained mutatis-mutandis from the already existing ones in the deterministic case, as those from [1].

The knowledge of the asymptotic structure of the stabilizing solution of the Riccati equation allows us to avoid the ill conditioning of the numerical computations required for obtaining the gain matrix of the optimal control. Also, the analysis performed in this work may be used for the design of a near optimal control for many practical applications in which the values of the small parameters are not precisely known.

Bibliography

[1] V. Dragan, A. Halanay, *Suboptimal Stabilization of Linear Systems with Several Time Scales*, Int. J. Control, 36, 1, 109-126, (1982).