8. LATVIJAS MATEMĀTIKAS KONFERENCE

Valmiera, 9.–10. aprīlis, 2010

TĒZES

8th LATVIAN MATHEMATICAL CONFERENCE

Valmiera, April 9–10, 2010

ABSTRACTS

LATVIJAS MATEMĀTIKAS BIEDRĪBA
VIDZEMES AUGSTSKOLA
LATVIJAS UNIVERSITĀTE

Acta Societatis Mathematicae Latviensis
Abstracts of the 8th Latvian Mathematical Conference, April 9–10, 2010, Valmiera, Latvia

ON STABILITY ANALYSIS OF IMPULSE MARKOV DYNAMICAL SYSTEMS

JEVGENIJS CARKOVS and OKSANA PAVLENKO

Probability Theory and Mathematical Statistics Department
Riga Technical University

Meža iela 1/4, Rīga LV-1048, Latvia

E-mail: carkovs@latnet.lv, Oksana.Pavlenko@rtu.lv

The paper deals with linear Impulse Dynamical System (IDS) in $\mathbb{R}^n$. The phase coordinates $x_\varepsilon(t)$ of this IDS are tagged by small positive parameter ε and controlled by right continuous piecewise constant ergodic Markov process (MP) with infinitesimal operator

$$Q_\varepsilon v(y) := a(y,\varepsilon)\sum_{z\in\mathbf{Y}}[v(z)-v(y)]p(y,z,\varepsilon), \tag{1}$$

where $v(y)$ is bounded mapping of $\mathbf{Y}$ to $\mathbb{R}$. The phase trajectories of IDS satisfy differential equation

$$\frac{dx_\varepsilon(t)}{dt} = \varepsilon A_1(y_\varepsilon(t))\,x_\varepsilon(t) + \varepsilon^2 A_2(y_\varepsilon(t))\,x_\varepsilon(t) \tag{2}$$

for any $t \in (\tau^\varepsilon_{j-1}, \tau^\varepsilon_j)$, $j \in \mathbf{N}$ where $\{\tau^\varepsilon_j, j \in \mathbf{N}\}$ are switching moments of MP. At any switching moment τ^ε_j of MP the phase motion $x_\varepsilon(t)$ has a jump

$$\begin{aligned} x_\varepsilon(\tau^\varepsilon_j) = x_\varepsilon(\tau^\varepsilon_j - 0) \quad &+ \varepsilon B_1(y_\varepsilon(\tau^\varepsilon_j), y_\varepsilon(\tau^\varepsilon_j - 0))\,x_\varepsilon(\tau^\varepsilon_j - 0) \\ &+ \varepsilon^2 B_2(y_\varepsilon(\tau^\varepsilon_j), y_\varepsilon(\tau^\varepsilon_j - 0))\,x_\varepsilon(\tau^\varepsilon_j - 0) \end{aligned} \tag{3}$$

Our paper suggests asymptotic methods of Lyapunov stability analysis of IDS (2)-(3) equilibrium including not only classical Krylov-Bogolyubov averaging method but also stochastic approximation procedure, that permits for sufficiently small ε to reduce a stability problem to analysis of linear stochastic Itô differential equation in $\mathbb{R}^n$ with constant coefficients. Some of reporting results have been published in [1].

REFERENCES

[1] J. Carkovs and O. Pavlenko. Averaging, merger and stability of linear dynamical systems with small Markov jumps. In: *Proc. of the 9th Intern. Conference APLIMAT-2010, Bratislava, Slovak Republic*, 2010, 131 – 139.