

TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV



INTERNATIONAL CONFERENCE
**PROBABILITY, RELIABILITY AND
STOCHASTIC OPTIMIZATION**

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ODESSA NATIONAL MARITIME UNIVERSITY, MECHNIKOV STR. 34, ODESSA 65029, UKRAINE
E-mail address: postan@ukr.net

INFINITESIMAL GENERATOR FOR THE DISCRETE HIDDEN MARKOV MODEL

S. A. Semenyuk¹, Ya. M. Chabanyuk², U. T. Khimka³

Consider hidden Markov model (HMM) as a two-component process $z_t = (x_t, y_t)$. Here the HMM state process $x(t), t \geq 0$ is uniformly ergodic Markov process in the standard phase space (X, \mathbf{X}) with a generator [1]:

$$Q\varphi(x) = q(x) \int_X P(x, dy) [\varphi(y) - \varphi(x)], \quad \varphi \in \mathbf{B}(X),$$

\mathbf{B} denotes Banach space of real bounded functions with supremum norm $\|\varphi\| = \max_{x \in X} |\varphi(x)|$. Let process $x(t)$ have stationary distribution $\pi(C), C \in \mathbf{X}$.

And the HMM observation process $y(t), t \geq 0$ is a sequence of random variables with set of probability mass functions: $b_x(y) = P[y_t = y | x_t = x], y \in Y$.

It can be shown that the process z_t is Markovian, moreover, it is ergodic and stationary if x_t is ergodic and stationary [2].

Lemma 1. *Infinitesimal generator for the two-component Markov process $z_t = (x_t, y_t), t \geq 0$ has the form:*

$$L\varphi(x, y) = q(x) \int_X P(x, ds) \sum_{p \in Y} [b_s(p)\varphi(s, p) - b_x(p)\varphi(x, p)], \quad \varphi \in \mathbf{B}(X, Y).$$

Obtained result allows to consider and study complex stochastic systems that depends on hidden Markov models [3].

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¹ LVIV POLYTECHNIC NATIONAL UNIVERSITY, S. BANDERA STR. 12, LVIV 79013, UKRAINE
E-mail address: semenyuk@gmail.com

² LVIV STATE UNIVERSITY OF LIVE SAFETY, KLEPARIVSKA STR. 35, LVIV 79000, UKRAINE
E-mail address: yaroslav.chab@gmail.com

³ LVIV POLYTECHNIC NATIONAL UNIVERSITY, S. BANDERA STR. 12, LVIV 79013, UKRAINE
E-mail address: ulyana.himka@gmail.com