International Conference

Stochastic Processes in Abstract Spaces

14 – 16 October, 2015

Kyiv, Ukraine

□ **Program**

□ **Abstracts**

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Organized by:

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Institute of Mathematics, National Academy of Sciences of Ukraine

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Parameter estimation in one model with measurement error

O. O. Synyavska

We consider a stochastic process $\{\xi(t), t \in [0,1]\}$ such that $E\xi(t) = 0, E\xi(t)\xi(s) = \frac{1}{2}\left(|t|^{2H} + |s|^{2H} - |t-s|^{2H}\right), t, s \in [0,1], H \in (0,1)$, with increments of the class K_1 [1] and the following measurement error problem for fixed $n \geq 1$ observed variables $X(0), X\left(\frac{1}{a_n}\right), \ldots, X(1)$ differ from the true values of the process $\xi(t)$ in the points $\left\{\frac{k}{a_n}\middle|0 \leq k \leq a_n, n \geq 1\right\}$, $(a_n) \subset \mathbb{N}$, $a_n \to +\infty, n \to \infty$, by as error in observations $\{\delta_{k,n}|0 \leq k \leq a_n\}$ which are independent from $\{\xi\left(\frac{k}{a_n}\right)|0 \leq k \leq a_n\}$, that is $X\left(\frac{k}{a_n}\right) = \xi\left(\frac{k}{a_n}\right) + \delta_{k,n}$. We assume that $\delta_{k,n}$ are i.i.d. Gaussian random variables such that $\delta_{k,n} \simeq N(0, \sigma_n^2)$ with known σ_n^2, $0 \leq k \leq a_n$, $n \geq 1$. For the observations in this measurement error model of random process $\{X\left(\frac{k}{a_n}\right)|0 \leq k \leq a_n\}$ we obtain an estimate of parameter H and construct non-asymptotic confidence intervals.

Theorem 1. *Let $H \in (0, H^*], H^* < 1$ and $\sum_{n=1}^{\infty} a_n^{4H^*-1}\sigma_n^4 < +\infty$. Then the statistics $\hat{H}_n = \frac{1}{2}\left(1 - \frac{\ln S_n(X)}{\ln a_n}\right)$, where $S_n(X) = \sum_{k=0}^{a_n-1}\left(X\left(\frac{k+1}{a_n}\right) - X\left(\frac{k}{a_n}\right)\right)^2 - 2a_n\sigma_n^2, n \geq 1$, is the strongly consistent estimate of the parameter H.*

Theorem 2. *Let $H \in (0, H^*]$ with $H^* < 1$ known. Then $P\left\{\hat{H}_n - l_p(n) < H < \hat{H}_n + r_p(n)\right\} \geq 1 - p$, $l_p(n) \geq -\frac{1}{2}\frac{\ln\left(1-\sqrt{\frac{2D_n(H^*)}{p}}\right)}{\ln a_n}$ if $\sqrt{\frac{2D_n(H^*)}{p}} < 1$, $r_p(n) \geq \frac{1}{2}\frac{\ln\left(1+\sqrt{\frac{2D_n(H^*)}{p}}\right)}{\ln a_n}$,*

$$D_n(H^*) = \begin{cases} \frac{2}{a_n}\left(6 + \zeta(4-4H^*)\right) + 8a_n^{4H^*-1}\sigma_n^4, & H^* \in (0, \frac{3}{4}); \\ \frac{2}{a_n}\left(6 + (1 + \ln a_n)\right) + 8a_n^2\sigma_n^4, & H^* = \frac{3}{4}; \\ \frac{2}{a_n}\left(6 + \frac{a_n^{4H^*-3}}{4H^*-3}\right) + 8a_n^{4H^*-1}\sigma_n^4, & H^* \in \left(\frac{3}{4}, 1\right). \end{cases}$$

References

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Author index

Aryasova O. V., 9

Blazhievska I. P., 10

Bodnarchuk I. M., 11

Bodnarchuk S. V., 12

Dorogovtsev A. A., 1, 13

Engelbert H.-J., 2

Fomichov V. V., 14

Ganychenko Iu., 15

Şençimen C., 60

Glinyanaya E. V., 16

Golichenko I., 17

Gonchar I. V., 18

Gorodnii M. F., 18

Herych M. S., 19

Iksanov A., 20

Ivanenko D. O., 21

Ivanov A. V., 3, 22

Izyumtseva O. L., 13

Klesov O. I., 23, 24

Knopov P. S., 4

Knopova V., 25

Kolesnik A. D., 26

Kopytko B. I., 27

Korenovska I. A., 28

Krasnitskiy S. M., 29

Kukush A., 5, 30

Kulik A. M., 31

Kurchenko O. O., 29

Kuznetsov V. A., 32

Luz M. M., 34

Manita O. A. , 35

Marynych A. V., 36

Masyutka O., 17

Mbaye Mamadou Moustapha, 37

Moklyachuk M. P., 17, 34, 38, 39

Molyboga G. M., 40

Moskvychova K. K., 41

Orlovskyi I. V., 22

Ostapenko V. I., 38

Osypchuk M. M., 42

Pashko A. A., 43

Pavlenkov V. V., 44

Pehlivan S., 60

Pilipenko A., 45, 46

Portenko M. I., 47

Postan M. Ya., 48

Prokhorenko N. V., 50

Proske F., 6

Pryhodko V. V., 51

Prykhodko Yu., 46

Račkauskas A., 52

Radchenko V. M., 53

Riabov G. V., 54

Rigo Pietro , 55

Ruffino P., 58

Savych I. N., 59

Shevchuk R. V., 27

Shklyar S. V., 61

Sidei M. I., 39

Slyusarchuk V. Yu., 7

Slyvka-Tylyshchak A. I., 62

Sobolieva D., 63

Stanzhytskyi O. M., 64

Synyavska O. O., 65

Tantsiura M. V., 66

Tsaregorodtsev Ya., 30

Tymoshenko O. A., 24

Yamnenko R. E., 67

Zaigrajew A., 8

Zhurakovskyi B. M., 68

Zinchenko N. M., 69

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