ADAPTIVE RADIOINTERFEROMETER WITH MICROPROCESSOR OF A SIGNAL IN THE MOBILE STATION OF A TROPOSPHERE COMMUNICATION

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Abstract

In the presentation is decides scientific problem of the application of adaptive radio-interferometer in the mobile station of a troposphere communication by modern realization of digital regimes for two-contours processing of troposphere signals, which is allow to increase signals stability and information reliability of the mobile station.

1.INTRODUCTION

A problem increasing reliability of the station troposphere communication (STC) is actuale. It is connected with changes characteristics troposphere. If these changes is always under controlle, which provides given information reliability STC. Stability of the troposphere signal could be provided by using adaptive radiointerferometer (RI) in STC which has two antennas. Connecting of two STC antennas by twoelement scheme of adaptive RI, using of two processors operating of signals, two contours of adaptation and adaptive algorithm of monitoring in zone STC will provide troposphere signal stability and information reliability of STC.

2. GOAL OF RESEARCH

A methods of decision are the methods two-contour's processing with help of maximum signal noise ratio (MSNR) criterion and limiting the sensitivity of receiver (LSR) by special ideology of constracting of adaptive two-elements radiointerferometer [1].

3. PROBLEM SOLUTION

Adaptive RI is built so, that its additive output is connected with first cotour of adaptation and main processor (MP) and multiplicutive output – with second cotour of adaptation and additional processor (AP). Two contours of adaptation are synchronized with the help of adaptive algorithm of monitoring in zone STC [2]. Adaptive algorithm of monitoring identificates signals by outputs of twocontours of adaptation. Changes of operators $I^{A}_{Z_{TPij}}$ and $I^{O}_{Z_{TPij}}$ addutives components of troposphere signal by maximum signal to noise ratio criterion (MSNR) are controlled in the first cotour.

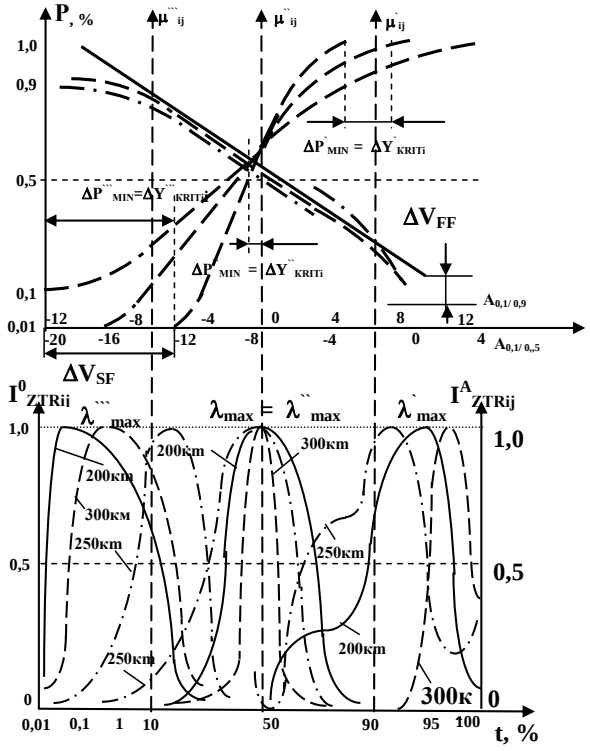

Fig. 1. Determination of laws distribution $\Delta V_{FF,SF}$ by changes operators I^{0}_{zTRij} and I^{A}_{zTRij}

Changes of operators $I^{A}_{Z_{TPij}}$ and $I^{O}_{Z_{TPij}}$ multiplicative components of troposphere signal by limit receirver sensitivity criterion (LRS) are controlled in the second cotour. Results of controll on the output of two contour of adaptation are presented on Fig. 1,2 and reply to equation

$$\max\min[\Delta V_i] = \{10\lg\frac{(\max\Delta V_i)}{(\min\Delta G_i)\sqrt{\frac{I(r)}{(L-1)!2P_{ER}}}}\} - \max\min[\Delta G_i],$$

where operators $[\max\Delta V_i]$ and $[\min\Delta G_i]$ is optimal, J(r)- integral of probability, L – multiple of diversity of reception, P_{er} – error probability of received information, P_{min} –minimum value of receiver threshold level ΔP_{min}, Y_{crit}- critical value of fast and slow fading signal to noise ratio.

Twocontour operating of signals is done with the aim of determination of low distribution fast fading (FF) and slow fading (SF) signals, where $\Delta P_{min}=Y_{crit}$ is minimal and reply to values $A_{0,1/0,9}$ (by FF) and $A_{0,1/0,5}$ (by SF), which are presented on Fig.1, accordingly with the condition of equality of operators by two contours

$$\Delta V^{APR}_{FF,SF}(A^{APR}_{TR.RI}, I^{A_{APR}}_{TR.RI}, I^{O_{APR}}_{TR.RI}) = \Delta V^{APOST}_{FF,SF}(A^{APOST}_{TR.RI}, I^{A_{APOST}}_{TR.RI}, I^{O_{AAPOST}}_{TR.RI}) = \Delta G_i(I^O_{TRi}/I^A_{TRi}).$$

It`s conditioned by realization in STC with adaptive RI four-multiple space-device receiving of signals with operating there in first contour of adaptation by MSNR criterion and also eight multiple frequency-device receiving of signals in the second cotour of adaptation by LRS criterion, accordingly to adaptive algorithm of monitoring in the situation $\lambda_{ij}(\mu_{ij})$

$$C[n+1] = C[n][1 - sign\{\Delta\Im^{APOST}_{\chi_o}[n] - \Im^{*APOST}_{\chi_o}[n-1]\} - sign\{\Delta P_{\min}[n] - \Im^{*APOST}_{\chi_o}[n-1]\} + \{E[s]\}\{sign(\Delta\Im^{APOST}_{\chi_o}[n] - \Im^{*APOST}_{\chi_o}[n-1]) + sign(\Delta P_{\min}[n] - \Im^{*APOST}_{\chi_o}[n-1])\}],$$

where n=1,2,…- numerals of itarations of optimization 0f channel multiple of space-frequence device in STC for interval ΔT_n for FF and slow SF signals;

$\Im^{AПOCT}_{\chi_0}(\Lambda_i) = \sum_{i=1}^{n}\left[X^P_{i\chi}\prod_{j=1}^{m}\exp\left\{-0{,}13\Delta T_i e^{-\frac{Y^2_{KPITi}}{2\sigma_i^2}}\right\}\right]$ - index of information reliability of STC;

$[P_{ER}\ \{Y^{APR} < Y^{APOST}_{KRITi}\}]$- condition of comparing of signals of adaptation, which are depended from P_{ER}, numerical of iterations and σ_1/σ ratio on Fig.2.

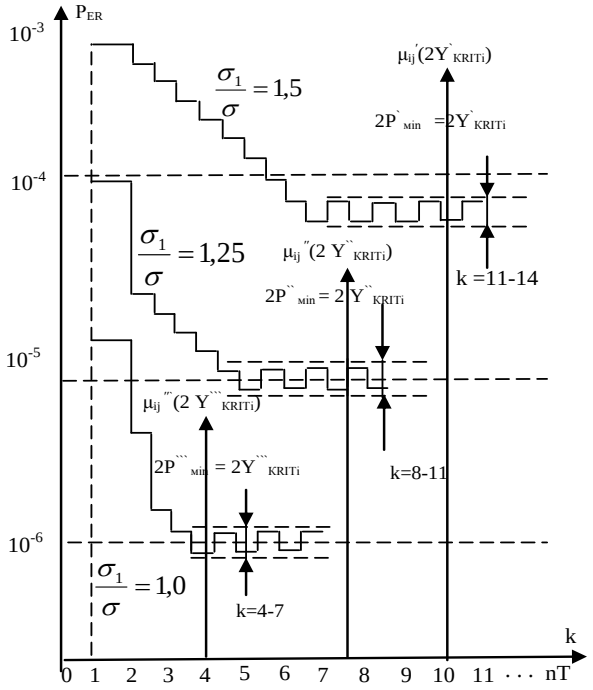

Fig. 2. Determination P_{ER} by adaptive of changes number of iterations and threshold level of receiver.

Calculated results are presented in the tabl.1 and reply Fig.1,2. Adaptive controll regime by two contours by condition $Y<Y_{KRITi}$, for example, for first contour of adaptation AN/TRC-66A is performed - 16,45<20,85, but for AN/TRC-66 isn`t performed - 8,63<5,12. For second contour of adaptation AN/TRC-66A is performed - 17,60<30,4 and for AN/TRC-66 is performed - 9,82<11,7.

Table 1

№ STC	Typ STC	Output 1-th contour of adaptation $Y<Y_{KRITi}$	Output 2-th contour of adaptation $Y<Y_{KRITi}$
1	AN/TRC-66	8.63 < 5.12	9.82 < 11.7
2	AN/TRC-66A	16.45< 20.85	17.60 < 30.4
3	AN/TRC-80	7.04 < 6.05	8.13 < 10.4
4	AN/TRC-90	18.3 < 15	19.5 < 21.9
5	AN/TRC-90A	12.85 < 10.70	14.0 < 15.0
6	AN/TRC-90B	20.18 < 17.98	21.3 <2 6.8
7	AN/TRC-97	3.77 < 7.83	11.5 < 16.7
8	H-3112/ H-3122	21.52 < 20.9	23.5 < 27.5
9	FM 1970	21.59 < 21.9	21.6 < 21.9

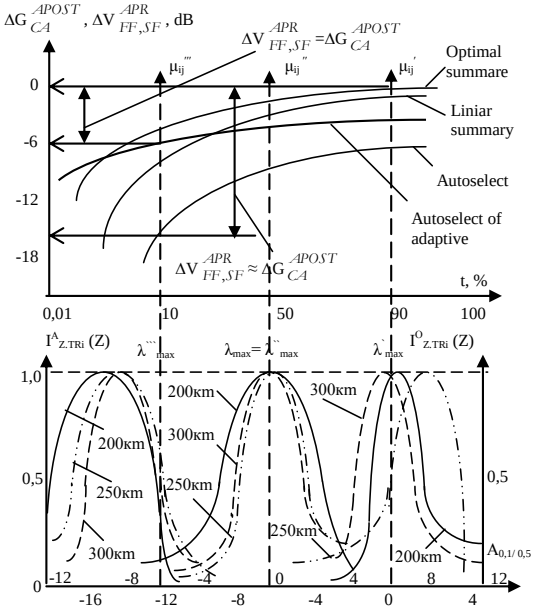

Fig. 3. Adaptive RI with maine regimes work and new -"Adaptive select"

4. RESEARCH RESULTS

Results of solution is realezation:

1. 4-th multiple space-device signal receiving with operating there in first contour of adaptation by MSNR criterion.

2. 8-th multiple freqence-device receiving of signals in the second cotour of adaptation by LRS criterion.

3. Adaptive RI, which allaus to obtain, by changes of amplitude of troposphere signals within 2,6dB to 10,8dB information reliability of STC [1,2].

4. The regime "Autoselect" is adaptive, which reply to regime of the work of adaptive RI as adaptive automat [2] and has advantage by cjmparison with regimes "Liniar summary", "Optimal summary".

5. CONCLUSION

Adaptive RI by changes of amplitude of troposphere signals within 2,6dB to 10,8dB provides information reliability of the STC 0,995-0,999 [1, 2].

REFERENCE

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2. Rudakov V. I. Adaptive monitoring algorithm for the operat rang of distant troposphere communications systems // Proceedings of the 5-th International Conference on Antenna Theory and Techniques. - National Technical University of Ukraine "Kyiv Polytechnical Institute" - 2005, 24-27 May. - Kyiv, Ukraine. - P. 268…270.