Estimation of the Coordinates of Radiation Source Taking into Account Receiving Points Location Definition Error in Radio Systems with Minimal Amount of Carriers Moving Around[1]

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Received in final form January 18, 2014

Abstract—There are represented the algorithms of estimation of radiation source in angular-measuring and differential distance-measuring radio systems with minimal amount of carriers moving around, taking into account the errors of receiving points location on a basis of adaptive filtering with method expanded state vector split. There are represent the results of static simulation.

Current-technology radio monitoring systems are characterized by application of radiosystems with minimal amount of moving sensors carriers, realizing measuring recurrent processing of the single position parameter together with application of multiposition ones.

Questions of the synthesis of the algorithms for calculation of radiation source (RS) coordinates in such systems are considered for cases of angular-measuring method (AM) and difference distance-measuring method (DDM) for location definition in [1, 2]. At that, coordinated of receiving points (RP) are assumed as exact.

But in practice there are also errors of topological binding, which decrease essentially efficiency of algorithms, synthesized for a case of assumption of absence of such errors in location definition algorithms [3]. Therefore, algorithms of RS coordinates calculation in radio systems with minimal amount of moving carriers must be synthesized taking into account RP coordinates definition errors.

Known approach to accounting of PR coordinates definition lies in their recalculation into equivalent noise of location parameters modification [4]. Alternating approach proposes estimation of expanded state vector [5], including PR coordinates together with RS coordinates. Question of the synthesis of the algorithms for estimation of expanded state vector in angular-measuring and difference distance measuring radio systems with minimal amount of moving carriers are considered in [6] for a case of uniform line motion of receiving points. These results are possible to be specified in case of RP moving around.

The purpose of this paper is synthesis of the algorithm of RS coordinates estimation together with coordinates of moving around RP and its comparative analysis with known algorithm, realizing RP coordinates errors recalculation into equivalent measurement noise.

We restrict ourselves by the case of immovable RS at the plane. We introduce expanded state vector $\mathbf{y}_k = (\mathbf{x}_k^T, \mathbf{u}_k^T)^T$ including vectors of RS Cartesian coordinates $\mathbf{x}_k = (X_k, Y_k)^T$ and RP polar coordinates $\mathbf{u}_k$ at kth timepoint. At that $\mathbf{u}_k = \mathbf{u}_{1k}$ in case of realization of AM and $\mathbf{u}_k = (\mathbf{u}_{1k}^T, \mathbf{u}_{2k}^T)^T$ in case of realization of DDM, where $\mathbf{u}_{1k} = (R_{p1k}, \varphi_{p1k})^T$, $\mathbf{u}_{2k} = (R_{p2k}, \varphi_{p2k})^T$ are vectors of polar coordinates of

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[1] The paper was done under support of grant of the President of Russian Federation for young scientists—Science Doctors (MD-2934.2012.10).