UDC 621.371: 550.837.6

ANALYSIS METHODS OF TREATMENT INCOHERENT RADAR IMAGES IN REMOTE SENSING SYSTEM BASED ON FILTER SPECKLE – NOISE

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The analysis of non-coherent processing of radar imaging methods. Availability speckle - noise leads to deterioration decryption radar image (RI), radiometric resolution and accuracy of the measurement object components radar portrait, as well as increased requirements for the data channel and means for displaying information. The main method of reducing speckle - noise is filtering (linear, adaptive and combined methods) generated as a result of the synthesis of the amplitude or luminance RI. Home treatment of such filtering - incoherent accumulation.

Introduction. Radar systems of space-based earth surveillance are an effective means of obtaining the operational and long-term information about the state and dynamics of objects and regions of the globe in global and regional scale, regardless of weather conditions and time of day.

The scientific and engineering basis for the implementation of such systems was laid in the middle of the last century. They were prepared by advancements in aircraft instrumentation, including the development of the Research Institute – 17 panoramic radar "Cobalt" for on-board equipment of the complex impact "Rubidium" Tu – 4 (1949). With this apparatus the problem of navigation and aiming was solved for large area objects in the absence of optical visibility [1–5].

Improving equipment (introduction of frequency tuning, color display, automatic detection of objects on the Earth's surface, and others.), and most important, the transition from the panoramic radar for radar side-looking (DBR) with improved angular resolution in azimuth (up to 9 ... 15 arc. min), contributed to the development of a new use of radar – earth surveillance.

Intensive research on improving radar earth surveillance led to the creation of fundamentally new means of radar – coherent radar antenna synthetic aperture (SAR), can solve the problem of radio-wave with a spatial resolution in the unit and of a meter [6 – 10].

Main part. Historically, the first generation of cosmic X-ray diffraction was permitted on the horizontal distance coarser than the resolution limit. Optical signal was used for the synthesis of RI `processing device selection synthetic aperture so as to have the same resolution in both coordinates. Available stocks signal duration was used for non-coherent accumulation.

The method in which a single element resolution synthetic diagram directivity antenna (DNA) averaged radar images obtained at different Doppler frequencies (within element incoherent accumulation), called «Multi-look» in foreign literature. Figure 1 is a block diagram within Element incoherent accumulation. With digital synthesis RI implementation within Element savings achieved by separation into sub-aperture signal, coherent processing (partial synthesis complex radar images (CRI) obtained at different Doppler frequencies with different local azimuth angle), and the subsequent detection of the partial summation of radar images. Instead of a time signal separation can be applied separation azimuth spectrum of Doppler frequencies subspectre followed by their synthesis, detection and partial summation of radar images. The same incoherent accumulation operation can be performed in range. In principle, the number of cases does not have to be an integer, for example, optical or accumulation of overlapping sub-aperture (subspectre).

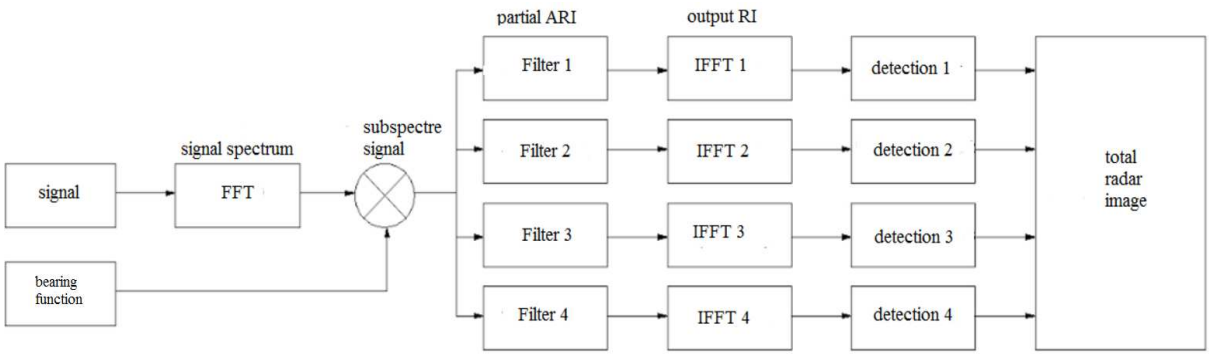

Fig. 1. Block diagram within Element incoherent accumulation

One of the most effective and widely used in the synthesis of RI autofocus algorithms is phase - gradient algorithm phase-gradient algorithm (PGA) autofocus based on the extraction of uncompensated phase error directly from the bright point targets. The theoretical justification of the algorithm synthesis came from radar images using compression Azimuth method of harmonic analysis. The input process for PGA algorithm in this case is pre-compressed in range radio- hologram, which compensated for the law chirp with residual disabilities that require removal. The resulting range in each channel complex SAR images is a range Radiohologrames. By applying Inverse Fast Fourier Transform (IFFT) operation can reverse transition from CRI Radiohologrames to partially compensate for deviation.

There are many embodiments of PGA algorithm. Its upgraded version is used as the input process part focused CRI compensation phase error is performed in the spectrum CRI azimuth, which is consistent with the original idea of the method in connection with the equivalence of Fast Fourier Transform (FFT) and IFFT procedures.

In addition to considering options within element incoherent accumulation is possible, and in some cases more promising option intercell incoherent accumulation, in which first obtained KRI with high resolution in both coordinates, and then after the detection is carried out by averaging the required number of observations. though this option requires more CPU performance synthesizing radar images, but for high-resolution X-ray diffraction it has a number of advantages:

1) the possibility of adaptive selection of the size and configuration of the averaging window for the use of modern automatic segmentation algorithms for radar data, wavelet - filtration, neural processing, the fractal analysis.

2) the possibility of radar pictures of small objects for recognition and classification after finding them on the smoothed image.

3) archiving and detailed radar images KRLI for later use, including interferometric processing of images taken at different times.

Block diagram intercell incoherent accumulation is shown in Figure 2. The input information is the luminosity RI or complex, after which detection is performed (square). Filtration speckle - noise may include linear operations, and not linear (logarithm, estimation of local parameters, etc.).

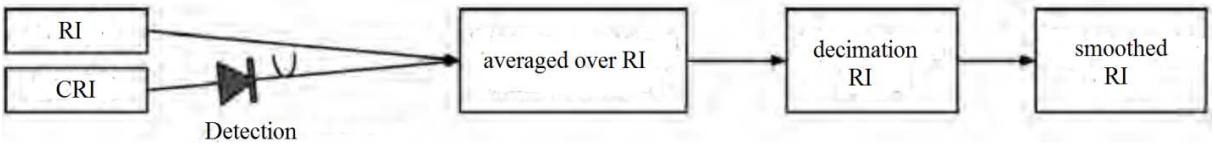

Fig. 2. Block diagram intercell incoherent accumulation

Tasks suppress speckle - noise can be divided into:

1) global, providing exposure to all the main radar image or a portion thereof. These include algorithms summation of independent radar data with constant parameters within the frame;

2) Local, based on local statistical evaluation. These include methods of improving deshifriruemost and visual properties of the radar image, but does not retain the measuring properties of radar images;

3) Non-local filtering methods wherein the first step of the processing performed in the local small block detection statistics are analyzed and determining the nature of the anomaly.

Conclusion. Methods of radar systems of space-based earth surveillance require an integrated approach for operational and long-term information about the state and dynamics of objects and regions of the globe in global and regional scale, regardless of weather conditions and time of day. Performance Optimization of probing signals and search RTS will contribute to the successful solution of a space-based applications. Application within Element incoherent accumulation gives the gain in improved radiometric resolution.

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