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METHOD OF TREATING INCOHERENT RADAR IMAGES IN REMOTE SENSING SYSTEM BASED ON FILTERING SPECKLE - NOISE

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The analysis of non-coherent processing of radar imaging methods is provided. The presence of speckle – noise leads to decryption complications of the radar image (RI), radiometric resolution and accuracy of the radar portrait component measurement of the object, 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 of RI. The main procedure for such filtering is incoherent accumulation or averaging of independent observations on the area of the selected window on the radar.

Introduction. A specific feature of radar signals reflected from different types of objects when irradiated with a narrow-band sounding microwave pulse is the presence of fluctuations (speckle noise), which are caused by interference of elementary reflectors forming the object. Principal in the formation of speckle noise is the ratio of the size of the object and the size of the image resolution element formed during coherent signal processing. For many artificial objects, such as aircraft, missiles, ships, the radar image is a set of bright marks from mirror points (dominant reflectors) with changes in the viewing angle. When broadband (or ultra-wideband) signals are used, the group object is divided into elements. Their mutual position during the synthesis can change under the influence of motion or shading. This leads to a violation of the coherence of the trajectory signal, a deterioration in the spatial resolution of the radar image, and an increase in the fluctuation.

The presence of speckle noise leads to a deterioration in the decipherability of the radar image, radiometric resolution and accuracy of measurement of the components of the radar portrait of the object, as well as to increasing the requirements for the data transmission channel and information display facilities. The main method of speckle noise reduction is the filtration of the resulting amplitude of the radar image or radar image by the energy corresponding to the squared amplitude.

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

The method in which a single element resolution of synthetic diagram directivity antenna (DNA) of averaged radar images obtained at different Doppler frequencies (within element incoherent accumulation) is called «Multilook» 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 we can apply separation azimuth spectrum of Doppler frequencies subspectre followed by their further synthesis, detection and partial summation of radar images. The same incoherent accumulation operation can be performed and occur 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).

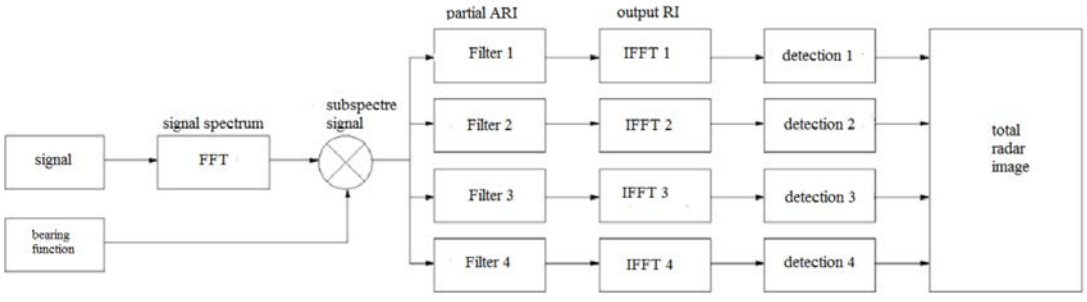

Fig. 1. Block diagram within Element incoherent accumulation

As the noise, we take the signal shown in Figure 2.

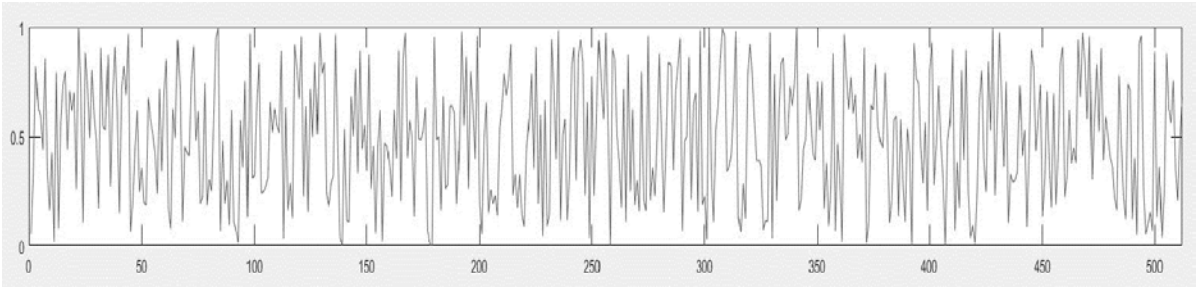

Fig. 2. Noise

As an input signal there will be a matrix of dimension 512x512. The result of matrix multiplication by noise is shown in Figure 3.

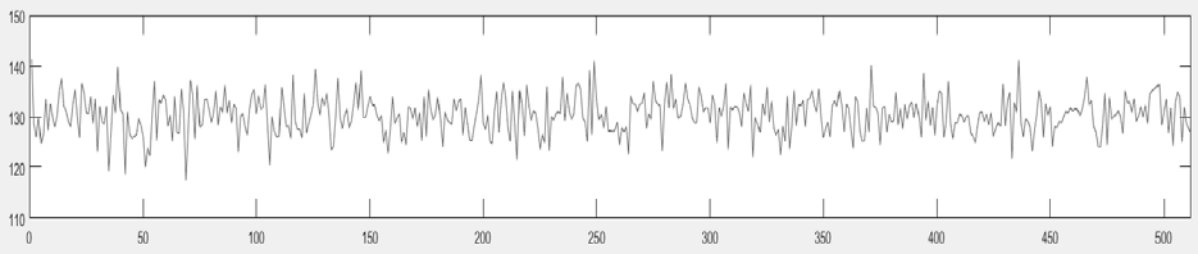

Fig. 3. Result of matrix multiplication with noise

The filter will use the Simple moving average Figure 4.

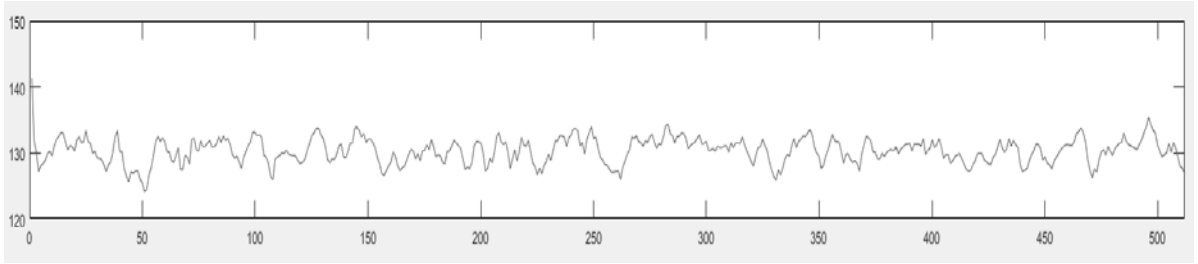

Fig. 4. Simple moving average

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. It can be seen from the figures that the moving average algorithm gives a small win in the speckle noise filtering.

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