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A NEW METHOD OF GROUND IMAGE RECONSTRUCTION WITH SHAPE RECOGNITION BY SAR SIGNAL MODELING

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Abstract. *This paper presents a new method of ground image reconstruction from synthetic aperture radar (SAR) signal. The method enables us to recognize the shape of objects to some extent without additional image processing, such as classification, segmentation, and edge detection. The received signal is modeled so as to take in the reflection coefficient of the ground surface properly, and the proposed method is designed to extract the reflection coefficient from the received signal as accurately as possible. Thus shape recognition becomes possible since the shape of objects is represented by the change of the reflection coefficient. The method is simple. It consists of two kinds of difference-based calculations. The background theory of the method is verified by mathematically rigorous argument, and a number of simulation examples are given to make sure the performance. The numerical examples show that the proposed method is able to successfully recognize shapes, sizes, and directions of various objects. Noise reduction problems are also discussed since the influence of noise, speckle in particular, is a big problem in SAR image reconstruction. Numerical experiments demonstrate that the application of the slightly modified multilook process works well and the shape recognition performance is still valid if the noise level is not too high.*

Keywords: SAR, Image reconstruction, Shape recognition, Speckle noise, Additive noise, Multilook process

1. **Introduction.** Synthetic aperture radar (SAR) has been widely used in collecting information about the surface of the Earth: ocean, forest, desert, iceberg, rivers, agricultural area, and so forth. In addition to geographical information, SAR provides important data to be analyzed for environment monitoring, disaster prediction, and so on ([12], [13], [17], [21]). SAR has advantages over the optical sensor since the observation activities are possible independently of time (daytime or night) and the weather (fine or thick cloud). Thus high-resolution SAR is of great use for military purposes, too. Methods of detecting militarily important objects and architectures have been presented also ([3], [14], [25]).