An Improved CLEAN Algorithm for ISAR

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In maritime radar, inverse synthetic aperture radar (ISAR) is used to image targets with classification typically performed by the radar operator. By automating the target classification, the operator workload will be reduced significantly and the classification accuracy can be improved. Automatic ship classification of ISAR imagery is traditionally based on the extraction of geometric features such as the ship length, width, centre of mass and the location of masts [1]. To further enhance the classification accuracy, traditional 2D-ISAR has been extended to 3D-ISAR with a number of alternative algorithms proposed in the literature [2–4]. In these algorithms, an important step is the extraction of the point-scatterers from the 2D-ISAR images, and that is typically achieved by the CLEAN algorithm.

The CLEAN algorithm is a popular signal processing technique used to extract point scatterers from a radar image, to produce a deconvolved or point-cloud representation. The standard algorithm works by assuming an image can be represented by a number of point sources that are modelled by a point spread function. The following three steps are then iterated: (i) find the location of the strongest peak, (ii) remove that peak from the image, and (iii) record the pixel location as well as the phase and amplitude of the removed local peak. However, a more robust approach to determine peaks in the areas of strongest backscatter is to use a 1D high resolution range profile of the target signal [5]. The proposed CLEAN technique exploits this representation to achieve a more balanced spread of scatterers in the final point cloud. In this presentation, the new CLEAN approach is demonstrated with a 3D temporal InISAR image formation algorithm [4] and applied to data of a large cargo vessel. The improvement is quantified by comparing estimates of the length, width and height of the target.

References

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