Single-channel SAR-GMTI Processing with Low Pulse Repetition Frequency

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For SAR-GMTI, the contradiction between imaging and detecting appeals to be that the detecting requires the targets focused, while the moving target focusing operation needs to be performed after having indicated the targets. Thus the Doppler ambiguity must be taken into account which includes the Doppler centroid ambiguity and the Doppler spectrum ambiguity. The Doppler centroid ambiguity occurs when the spectrum shift caused by the cross-track motion of the moving target is larger than the half of PRF; and if the azimuth instantaneous bandwidth is larger than PRF, the Doppler spectrum will be ambiguous. Here an approach is developed to solve the location and parameter estimation problems resulting from the targets with different velocities in different angles.

For the case that, PRF is less than the instantaneous bandwidth, which leads to the overlapping of the echo spectrum, spacial filtering is adopted to reconstruct the frequency spectrum before the Doppler ambiguity in multi-channel mode, and then a SAR imaging processing is performed. The capability of resolving the ambiguity is determined by the number of channels, the more the channels are, the stronger the ability of resolving the ambiguity. For multi-channel GMTI, it is necessary to implement clutter suppression before frequency spectrum reconstruction by searching the angle domain using the information of the degree of freedom in multi-channel spacial domain. However, the degree of freedom in spacial domain is also consumed by the clutter suppression, thus the degree of freedom in spacial domain for operating frequency spectrum reconstruction is diminished. For the situation that the number of channels is few, such as in the condition of two-channel, when the signal of the moving target is obtained after clutter suppression, there is only one degree of freedom in spacial domain, inadequate for the procedure of resolving ambiguity.