Use of a Space-time adaptive processing algorithm to optimize the detection of slow moving targets
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Introduction
A challenging problem faced by airborne ground moving target indicator (GMTI) radars is the ability to detect slow moving targets (i.e. dismounts) buried within a Doppler clutter ridge, which is an unwanted artifact of aircraft motion. Space-time adaptive processing (STAP) algorithms are advanced signal processing techniques that utilize a two-dimensional filtering technique and a phased-array antenna to mitigate platform-motion-induced-spread-Doppler clutter. This clutter interferes with the echo from slow moving ground targets, in addition to decreasing the severity of any jamming and interference that might also be present. Clutter, jamming, and interference reside in joint angle-Doppler space and together create one or more ridges within that space whose angle and behavior depends primarily upon the platform velocity, the Doppler frequency and the antenna orientation. The goal of this project is to use a Space Time Adaptive Processing (STAP) algorithm in a self-created simulated radar environment to optimize the rejection of clutter, jamming, and interference and thereby achieve a higher probability of successful location and identification.

Methods

Detectable Velocity (MDV), and the interference Eigenspectrum. These quantities allow one to determine the degree of successful clutter and jammer suppression achieved and thereby the overall effectiveness of radar performance. A graphical user interface was added to allow the user to test with multiple range rings in order to add additional training data to improve the ability to null the jammer and clutter, and also determine the effects of intrinsic clutter motion on overall interference suppression.

Results

Optimized data was achieved in the simulation and is displayed below.

Conclusion

The purpose of this project was to successfully simulate a radar environment and optimize the probability of detection of slowly moving ground targets. As shown in Graph 1, both the clutter due to aircraft motion and the jammer were nulled, allowing slow moving targets to be detected and localized. The optimized data allowed for the most realistic test, meaning the next logical step would be to test this algorithm using ‘real world’ radar training data to verify the algorithm’s effectiveness. Such algorithms represent the state of the art in advanced airborne military radar systems.

References

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