# Comparison of methods for handling the range-dependence of the clutter ridge for monostatic and bistatic STAP radars

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Detection of slow moving targets using a moving pulsed Doppler radar system has been a problem of great interest for quite some time [1]. One distinguishes between monostatic (MS) configurations, where the radar transmitter and receiver are colocated and bistatic (BS) configurations, where they are physically separated and have separated motions. In either case, a train of coherent pulses is transmitted and the corresponding returns are sensed at each of the elements of a linear antenna array.

Optimum clutter rejection is achieved using Space-Time Adaptive Processing (STAP) techniques. While STAP research was initially developped for MS configurations [1], it is now increasingly directed to BS configurations [2].
The adaptive weights used by STAP are computed using a clutter-plus-noise covariance matrix estimated from data collected at successive ranges. An accurate estimate of this matrix can be obtained only if the structure of the clutter spectrum remains unchanged over the range interval used for the estimation. The most significant feature of the clutter spectrum is a "clutter ridge" [1]. In the MS sidelooking (SL) configuration, characterizd by the fact that the antenna is oriented in the direction of the receiver velocity vector, the position, shape and size of this ridge remain constant as the range changes. In all other MS configurations and in all BS configurations, the ridge appearance changes considerably with range. This is the so-called "range-dependence problem" in STAP.

Three approaches have been proposed so far to deal with this problem. The "Doppler-warping" method works well in near-SL MS configurations. It has been applied to BS configurations but the reported performance is poor [2]. The derivative-based updating technique [2] shows good performance for all MS and BS configurations. However, this method does not provide exact range-dependence compensation when the complexity of the direction-Doppler curves is too high. Finally, the scaling method, based on geometrical properties of the Direction-Doppler (DD) curves, was initially developped for arbitrary MS configurations [4] and was applied to BS configurations in [3]. Reported performance are good only for selected BS configurations. In this presentation, we will present new range-dependence compensation methods that generalize the concept presented in [3,4]. These methods were developped using geometrical properties of the DD curves. Among them, one category of method has the property that they can work without any knowledge of the configuration parameters. We will discuss all of the above methods and discuss their performance in terms of their signal-to-interference-plus-noise ratio (SINR) loss.

## References

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