Motion Parameters Estimation of Manoeuvring Weak Target with Multiple Motion Stages based on RST-STFrFT

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Abstract

It is well known that long time coherent integration (LTCI) can effectively improve the radar detection ability of manoeuvring weak targets, since a considerable signal-to-noise ratio (SNR) improvement can be achieved [1]. However, for most existing LTCI algorithms [2-5], there is a common assumption that the observed target is of the single motion stage (i.e., the motion parameters of targets are uniform) during the coherent processing interval (CPI). However, with the advancement of manoeuvrability and the increasement of CPI, the observed target might be of multiple motion stages. In this case, the above-mentioned LTCI algorithms will not be effective any more. The specific LTCI algorithms developed for manoeuvring weak target with multiple motion stages are relatively few. In [6], a short-time generalized radon-Fourier transform (STGRFT) based LTCI algorithm is proposed to remove range migration (RM) and Doppler frequency migration (DFM) effects and estimate the stage-changing point. Similar as GRFT[5], STGRFT can be able to obtain an excellent SNR gain through multi-dimension parametric searching. In [7], a reference signal is introduced to compensate the motion parameters change (MPC) effect between different motion stages, and then GRFT is utilized to achieve the coherent integration during the CPI. However, the computational load of these algorithms is quite high, since the key procedure is based on the multi-dimension parametric searching. This may deteriorate the engineering practicability of these algorithms.

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