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基于前置接收机的天波超视距雷达回波模式辨识与定位精度提升

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Mode Identification and Positioning Accuracy Improvement Using Forward-based Receivers for OTHR

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摘要

天波超视距雷达（OTHR）目标跟踪面临着"三低"（低检测概率、低数据率、低测量精度）和"多径"（多条传播路径）的严峻挑战，准确的传播模式辨识与精确的目标定位是改善跟踪能力的关键。针对考虑高度信息的目标定位问题，提出了一套不依赖于电离层探测设备的天波超视距雷达与前置接收机（FBRs）量测的关联融合方法，以辨识传播模式并改善含高度的目标定位精度。首先推导了考虑目标高度的坐标变换公式，通过融合FBRs的量测可以获得目标地理位置和电离层高度的初步估计，然后采用极大似然估计准则建立了一套OTHR传播模式和杂波模式的辨识规则，最后利用最小方差估计准则实现OTHR和FBRs关联量测的融合以提高目标定位精度。仿真结果表明：提出的关联融合框架能够有效地辨识传播/杂波模式，同时可以估计出电离层高度和目标高度。此外，通过OTHR和FBRs的关联量测融合有效地改善了目标定位精度。

关键词： 天波超视距雷达(OTHR) 模式辨识 前置接收机 定位精度 数据融合 目标跟踪

Abstract:

Target tracking of over-the-horizon radar (OTHR) faces the challenge of low detection probability, low sampling rate, low measurement accuracy and multipath propagation. Both mode recognition of multipath propagation and target localization, significantly affect data association and estimate updating. In this paper, a scheme of measurement fusion of OTHR and forward-based receivers (FBRs) is presented to identify propagation modes and improve positioning accuracy. A coordinate transformation formula related to the target height is derived, and the measurements of FBRs are fused to obtain the preliminary estimates of the target state and ionosphere heights via an iterative least square method. Based on the above position estimate and OTHR measurements, a maximum-likelihood-estimation-based rule is proposed to identify the propagation/clutter modes. Finally, a minimum variance estimation method is given to improve positioning accuracy by fusing the associated data from OTHR and FBRs in ground coordinates. Simulation results show that the identification of propagation modes is satisfactory, the ionospheric heights and target heights can be estimated, and there is significant positioning accuracy improvement through fusing measurements of OTHR and FBRs.

Keywords: over-the-horizon radar (OTHR) mode identification forward-based receiver positioning accuracy data fusion target tracking

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