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基于扩展单脉冲比的拖曳式诱饵存在性检测

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Detection of Presence of Towed Radar Active Decoy Based on Extended Monopulse Ratio

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摘要 诱饵的存在性检测是对抗拖曳式有源雷达诱饵干扰的前提,也是决定抗干扰效果的重要因素。当导引头雷达发射多个不同频率的脉冲信号时,在一定的检测处理时长内目标回波信号幅度服从瑞利分布,而诱饵干扰信号则是幅度固定的。基于导引头雷达波束内诱饵存在导致的回波特征变化,通过提取诱饵存在/不存在两种情况下雷达接收回波信号的幅度特征差异以及对应单脉冲比特性变化,推导了两种假设条件下比幅测角扩展单脉冲比的条件概率密度函数,并在此基础上提出了采用Neyman-Pearson准则的广义最大似然比(GLRT)诱饵存在性检测方法以及干扰检测处理流程。不同干扰场景和条件下的仿真实验验证了该检测方法的有效性,能够满足拖曳诱饵干扰对抗的需求。

关键词: 拖曳式有源雷达诱饵   电子对抗   信号检测   扩展单脉冲比   广义最大似然比

Abstract: The detection of the presence of the decoy is the foundation of countering the towed radar active decoy (TRAD) and it determines the effect of the ECCM. When the radar seeker transmits several different frequency pulses, the echo amplitude of the target follows the Rayleigh distribution and that of the decoy is assumed fixed. This paper presents an analysis of the variation of the echo characteristic in the radar beam and when a towed decoy exists extracts the feature distinction of the echoes amplitude and the corresponding monopulse ratio under the two hypotheses that the decoy is present or not. The conditional probability density functions (pdfs) of the extended monopulse ratio are given when the radar seeker adopts the amplitude comparison monopulse under above two hypotheses are given. The detection of presence of the TRAD based on the generalized maximum likelihood ratio (GLRT) is developed which adopts the Neyman-Pearson method and the processing flow of the decoy detection is also given. Simulation results under different conditions and scenarios illustrate the performance of the proposed method is effective and satisfy the requirement of ECCM.

Keywords: towed radar active decoy   electronic countermeasure   signal detection   extended monopulse ratio   generalized maximum likelihood ratio

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