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论文

超宽带雷达生命信号频率检测的Cramer-Rao下界

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Cramer-Rao Lower Bound of Vital Signal Frequency Detection for Ultra Wideband Radar

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摘要 该文基于脉冲超宽带顺序信号模型和极大似然准则，结合Fisher信息矩阵和Cramer-Rao矩阵不等式，分析了UWB生命信号参数估计的泛化Cramer-Rao下界(CRLB)。根据等效时间采样原理，采用正弦位移函数近似生命微动信号，推导出了修正的UWB生命信号频率检测CRLB公式。仿真结果表明，增大观测时间、发射脉冲带宽以及系统信噪比可提高UWB雷达生命信号频率检测的精度。心跳信号检测比呼吸信号要求更高。

关键词： 生命信号检测 超宽带 Cramer-Rao不等式 Fisher信息 等效时间采样

Abstract： On the basis of the impulse Ultra Wide Band (UWB) sequential signal module and the Maximum Likelihood (ML) rule, the generalized Cramer-Rao Lower Bound (CRLB) for UWB vital signal parameter estimation is analyzed with the Fisher Information Matrix (FIM) and the Cramer-Rao matrix inequation. According to the equivalent time sampling principal, the improved CRLB formula of UWB vital signal frequency detection is derived by adopting a sinusoidal displacement function superseding the vital jiggle signal. The simulation results show that the frequency precision of UWB radar vital signal detection increases with increasing the survey time, the impulse bandwidth and the system SNR. The heartbeat detection demands more rigorous conditions than that of the respiration detection.

Keywords： Vital signal detection UWB Cramer-Rao inequality Fisher information Equivalent time sampling

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