

激光外差探测对振动目标多普勒频谱成像

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Doppler spectrum imaging of vibrating target using laser heterodyne detection

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摘要 图/表 参考文献 相关文章 (15)

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摘要 提出了采用激光外差技术探测振动目标,获取目标多普勒频谱图像,实现目标轮廓识别的方法.基于相位变化给出了目标振动形成外差信号的光电流模型;用扫描振镜控制激光光束方向实现对目标点扫描;通过振镜驱动电压触发数据采集卡,实现扫描与采集同步.利用频谱展宽占有比例的信号处理方式处理振动目标形成的多普勒频谱,简化了数据处理方式,有效消除了单个峰值噪声对信号的影响.实验中以5 MHz采样率测得两个目标在不同位置的特征频谱,得到了它的频谱展宽占有比例曲线;选取不同频谱展宽占有比例形成多普勒频谱图像,指出频谱展宽占有比例在0.7到0.9时能够形成良好的振动图像.文中结果证实了利用频谱展宽占有比例的数据处理方式探测振动目标是有效的,利用外差技术获取振动频谱图像是可行的.

关键词: 激光外差探测, 振动目标探测, 多普勒频谱成像, 目标识别

Abstract: To recognize the profile of a vibrating target, the Doppler spectral image of the target was captured by using the laser heterodyne detection method. A photo-current model of laser heterodyne signal from the vibrating target was derived based on the instant changing of phase, the target was scanned point by point in the laser direction controlled by a scanning galvanometer, and the data collection was synchro-controlled by the drive voltage of the galvanometer to synchronize data scanning and data capturing. A method called the Ratio in Broaden Spectrum (RIBS) to vibration signal processing was proposed to process the Doppler spectrum come from the vibration signal, by which the data processing was simplified and the effect of peak noise on the signal was eliminated. The characteristic spectra of two targets in different positions were detected at a 5 MHz sampling rate in the experiment to derive the RIBS curve, and Doppler spectrum imaging was captured with different RIBS, which show that when the optimal ratio is set from 0.7 to 0.9, the high quality vibration image can be obtained. The result demonstrates the validity of the RIBS in vibrating target detection and the feasibility of the laser heterodyne detection to capture spectrum images.

Key words: laser heterodyne detection vibrating target detection Doppler spectrum imaging target recognition

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