基于小波神经网络的切削刀具磨损识别

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关键词： 切削刀具 磨损 粒子群算法 小波神经网络

摘 要： 提出了一种基于小波神经网络的切削刀具状态监测方法，在采集切削加工功率信号的基础上，利用小波分解方法提取反映刀具磨损状态的信号特征量，利用小波神经网络的非线性模型和学习机制，实现刀具磨损状态的在线监测；针对多输入输出问题带来的网络规模大、收敛速度慢等问题，提出应用粒子群算法优化小波神经网络的方法，从而简化小波神经网络结构并加快收敛速度。仿真和应用实例证明，该方法比传统的基于BP的小波神经网络、GA优化的小波神经网络估计准确率高，消耗时间短。 Wavelet neural network (WNN) is used widely in tool wear detection, but the curse of dimensionality and shortage in the responding speed and learning ability is brought about by the traditional models. An improved WNN algorithm which combined with modified particle swarm optimization (PSO) was presented to overcome the problems. Based on the cutting power signal, the method has been used to estimate the tool wear. The Daubechies-wavelet was used to decompose the signals into approximation and details. The energy and square-error of the signals in the detail levels was utilized as characters which indicated tool wear, the characters were input to the trained WNN to estimate the tool wear. Compared with BP neural network, conventional WNN and genetic algorithm-based WNN, a simpler structure and faster converge WNN was obtained by the new algorithm, and the accuracy for estimate tool wear has been tested by simulation and experiments.

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