

控制科学与工程

基于模板匹配和镜像延拓的两阶段经验模态分解算法

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摘要: 针对传统经验模态分解算法存在的端点效应问题,提出了一种适用于脉搏信号分析的基于模板匹配和镜像延拓的两阶段经验模态分解算法。依据脉搏信号的类周期特征,首先识别其特征信息,分离出单一心动周期内的脉搏信号;然后使用信号相干平均技术获取脉搏信号模板,依据模板将首尾端点处的脉搏信号扩展至整个心动周期;最后采用镜像延拓方法对扩展后的脉搏信号进行经验模态分解。实验结果表明,扩展后的脉搏信号能够较好地模拟原信号首尾端点处的变化趋势,因此新算法能够有效抑制传统经验模态方法存在的端点效应问题,适用于诸如脉搏信号等具有类周期特征的生理信号分析。

关键词: 经验模态分解 模板匹配 镜像延拓 端点效应

A two-stage EMD algorithm based on template matching and mirror extension

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Abstract: To overcome the problem of end effects in the traditional empirical mode decomposition (EMD) algorithms, a two-stage EMD, named as TM-EMD, was proposed for the analysis of pulse signal. The TM-EMD used the methods of template matching and mirror extension and suited for the analysis of physiological signals, such as pulse signal, which have the inherent periodic characteristics. Firstly, the feature information (starting point, maximum point) of pulse signal were identified by TM-EMD, and the pulse signal was separated into different single cardiac cycles. Then the pulse template was generated using the signal coherent averaging technique. The beginning and the ending of pulse signal were extended into one whole cardiac cycle based on the pulse template. Finally, the mirror extension method was used to realize the process of EMD algorithm. Simulation results proved that the TM-EMD algorithm could better describe the trend of endpoints, and so could effectively restrain the end effects of the traditional EMD.

Keywords: empirical mode decomposition template matching mirror extension end effect

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