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### 雨流计数的递归算法

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### Recursive Algorithm for Rain-flow Counting

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摘要

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**摘要** 给出了疲劳分析中雨流计数法的另一种等效解释。在这个解释的基础上，提出了雨流计数的递归算法。该算法将包含多于一个应力峰值点的任意载荷-时间历程以两个谷值点为界分解成3个子段，每个子段用递归方法继续分解成3个更短的子段，直至每个子段仅包含一个峰值点或不包含峰值点为止。分解得到的仅包含一个峰值点的任意子段对应一个子循环，其应力的最大值和最小值在递归分解过程中可以同时算出。该算法不需像其他雨流计数算法那样在剔除局部子循环的峰、谷点数据后重新整理载荷-时间历程，也能保留各应力子循环出现的先后次序信息，且最先分离出来的可以是变程最大的应力循环。算法的缺点是不适合实时疲劳损伤计算，且算法在实现时需要计算机为其堆栈分配较多的存储器空间。

**关键词:** 疲劳 递归算法 雨流法 载荷历程 循环计数

**Abstract:** In this article, an alternative equivalent explanation for rain-flow counting in fatigue analysis is introduced, based on which a recursive rain-flow counting algorithm is proposed. The algorithm separates any load-time history with more than one peak into three sub-segments by two valleys; and every sub-segment with more than one peak is again separated into three shorter sub-segments recursively, till every sub-segment contains only one single or no peak. A sub-segment that contains a single peak corresponds to a load cycle whose minimum and maximum values are calculated simultaneously by the recursive procedure. The algorithm need not rearrange load-time history after eliminating the peak and valley values of extracted local cycles as is the case with some other rain-flow counting algorithms. It keeps the load cycle sequence information, and the first cycle extracted by the algorithm may be the one with the maximum range. The disadvantages of the algorithm are that it is not suitable for real-time application and that it requires the computer to assign a large amount of memory to stack in its implementation.

**Keywords:** fatigue recursive algorithms rain-flow method load histories cycle counting

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