

Research/Study - Back

Fatigue Identification from Low Back Surface EMG Signals Using Wavelets

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**Introduction:** It has been observed that during sustained muscle contractions, changes occur in the surface EMG signal. These changes, known as the mean and the median frequency shifts (FS), have been correlated to muscle fatigue. Zero-crossing (ZC) counting has been also used for the same purpose. In this study, the aim was to demonstrate a new processing technique for muscle fatigue identification. This technique was based on discrete wavelet transform (WT).

**Materials and Methods:** Five subjects were randomly selected for fatigue tests. Each subject performed one minute Sorenson test three times, with 5 minute rest between each 3 1/3 minute lifting tests. These tests were: (Test 1) standing without wearing lumbar support, (Test 2) lifting a load without lumbar support, and (Test 3) lifting a load with lumbar support. The lumbar support used was a modified belt designed to increase hoop stress along the low back. The EMG signals were recorded by surface electrodes placed on the spinae erector muscles (L3). the initial (0-4 sec) and the final (56-60 sec) EMG responses were recorded.

**Results: and discussion:** The normalized results of each tests are as follows: The Mean/Median FS were, 1/1, 0.96/0.95, and -0.14/-0.14, respectively. The ZC (initial - final) counted 1, 0.2, and -0.38. The signal energy differences calculated by WT were 1, 0.04, and 0.5, indicating more fatigue in Test 2 and less fatigue in Test 3.

**Conclusion:** The minimum FS was observed in Test 3 which matches our findings with WT. The energy value obtained shows that less fatigue was observed in Test 3.

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