H. Zabaleta, T. Keller, E. Fimbel. Gait analysis in frequency domain for freezing detection in patients with Parkinson's disease. Gerontechnology 2008; 7(2):247. Freezing of gait (FOG) is a common and disabling symptom of Parkinson's disease. It is an episodic and non-predictable phenomenon that affects most commonly the gait in the form of start hesitation and sudden immobility. Often it results in falling and consequent injuries such as joint dislocations, bruises, or skin lacerations[1,2]. The goal of the present work is to investigate whether freezing episodes can be reliably detected on-line using leg movement data measured by thigh, calf and ankle accelerometry and gyroscopy. **Methods** In this pilot study three people with Parkinson's disease were asked to perform gait and sit-to stand trials. Six points of the leg and hip were monitored using movement monitoring units. Each unit contained a three axis accelerometer (ADXL330, Analog Devices), and a two axis gyroscope (IDG – 300, Ivensense). All of the signals were recorded at 1000 Hz. During the trials, the motion of the body was also recorded using a Motion Analysis Hawk 6 Camera system. Freezing is more likely to appear in tasks that require attention, like sharp turns, walking in crowded environments, doorways, etc.; thus the tasks to be performed were designed to reproduce these situations: straight walking test for 5 m, turn and return, walking test with obstacle avoidance, backwards walking test, sit-stand-walk test and a dual task while walking. **Results and discussion** During FOG the persons often flutter although they remain in the same place. This is reflected in the frequency domain as an increase of the main frequency. Therefore, a time-series analysis method in the frequency domain (STFT) approach was used for analyze the accelerometric experimental data obtained during gait trials with people with Parkinson's disease. To use the STFT analysis, movement signals were first divided into overlapping or non-overlapping time frames and each frame was windowed and transformed into the frequency domain using FFT. For each window the main frequency, the maximal spectral power, the total spectral power, and the spectrum power above and below the dominant frequency were calculated. The preliminary results showed that the STFT analysis was able detect freezing episodes on-line and reliably using leg and hip movement data.

References

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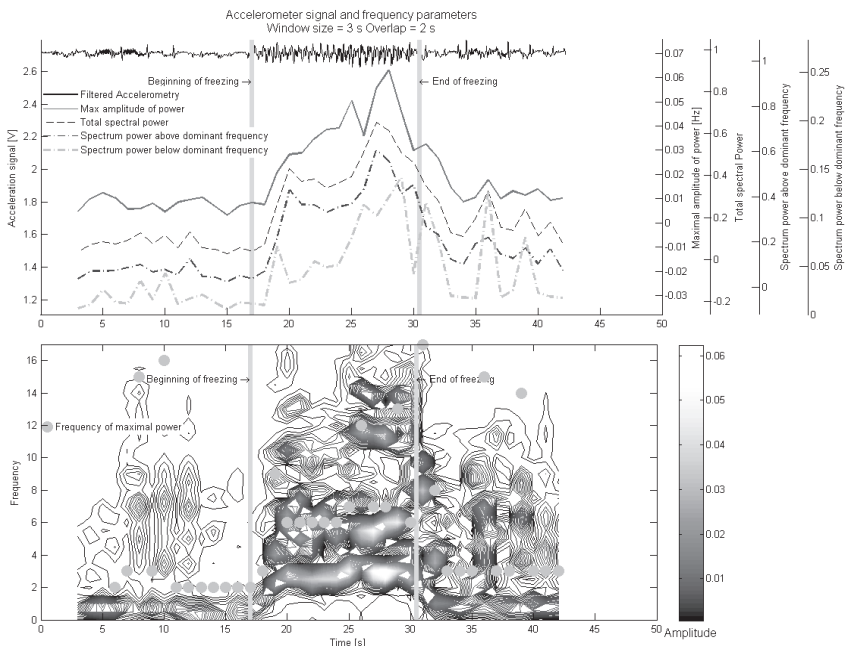*Address*: Fatronik Foundation, Spain; E: hzabaleta@fatronik.com

Figure 1 Movement data analysis with frequency domain parameters