

# Comparison of FFT and marginal spectra by Hilbert-Huang transform for broadband spectral analysis of EEG

Eduardo Arrufat-Pié<sup>1</sup>, Mario Estévez-Báez<sup>2</sup>, José Estévez-Carreras<sup>3</sup>, Calixto Machado-Curbelo<sup>2</sup>, Gerry Leisman<sup>4</sup>, and Carlos Beltrán<sup>2</sup>

<sup>1</sup>Hospital Comandante Manuel Fajardo

<sup>2</sup>Instituto de Neurologia y Neurocirugia

<sup>3</sup>Hospital Militar Dr. Luis Díaz Soto

<sup>4</sup>University of Haifa

August 4, 2020

## Abstract

Goal: Fast Fourier transform (FFT), has been the main tool for EEG spectral analysis (SPA). As EEG can show nonlinear and non-stationary behavior, FFT may at times be meaningless. A novel method was developed for analyzing nonlinear and non-stationary signals using the Hilbert-Huang transform. Methods: We compared spectral analyses of EEG using FFT with Hilbert marginal spectra (HMS) with a multivariate empirical mode decomposition algorithm. Segments of continuous 60-sec EEGs recorded from 19 leads of 47 healthy volunteers were studied. Results: HMS showed a reduction of the alpha activity (-5.64%), with increments in the beta-1 (+1.67%), and gamma (+1.38%) fast activity bands, an increment in theta (+2.14%), and in delta (+0.45%) bands, and vice versa for the FFT method. For weighted mean frequencies, insignificant mean differences (lower than 1Hz) were observed between both methods for delta, theta, alpha, beta-1 and beta-2 bands, and only for gamma band values. The HMS were 3 Hz higher than the FFT method. Conclusion: HMS may be considered a good alternative for SPA of the EEG when nonlinearity or non-stationarity may be present.

## Hosted file

2020-Arrufat-Pie-Estevez-Leisman-NumMethods-EEG-Normal.docx available at <https://authorea.com/users/348645/articles/473851-comparison-of-fft-and-marginal-spectra-by-hilbert-huang-transform-for-broadband-spectral-analysis-of-eeg>





